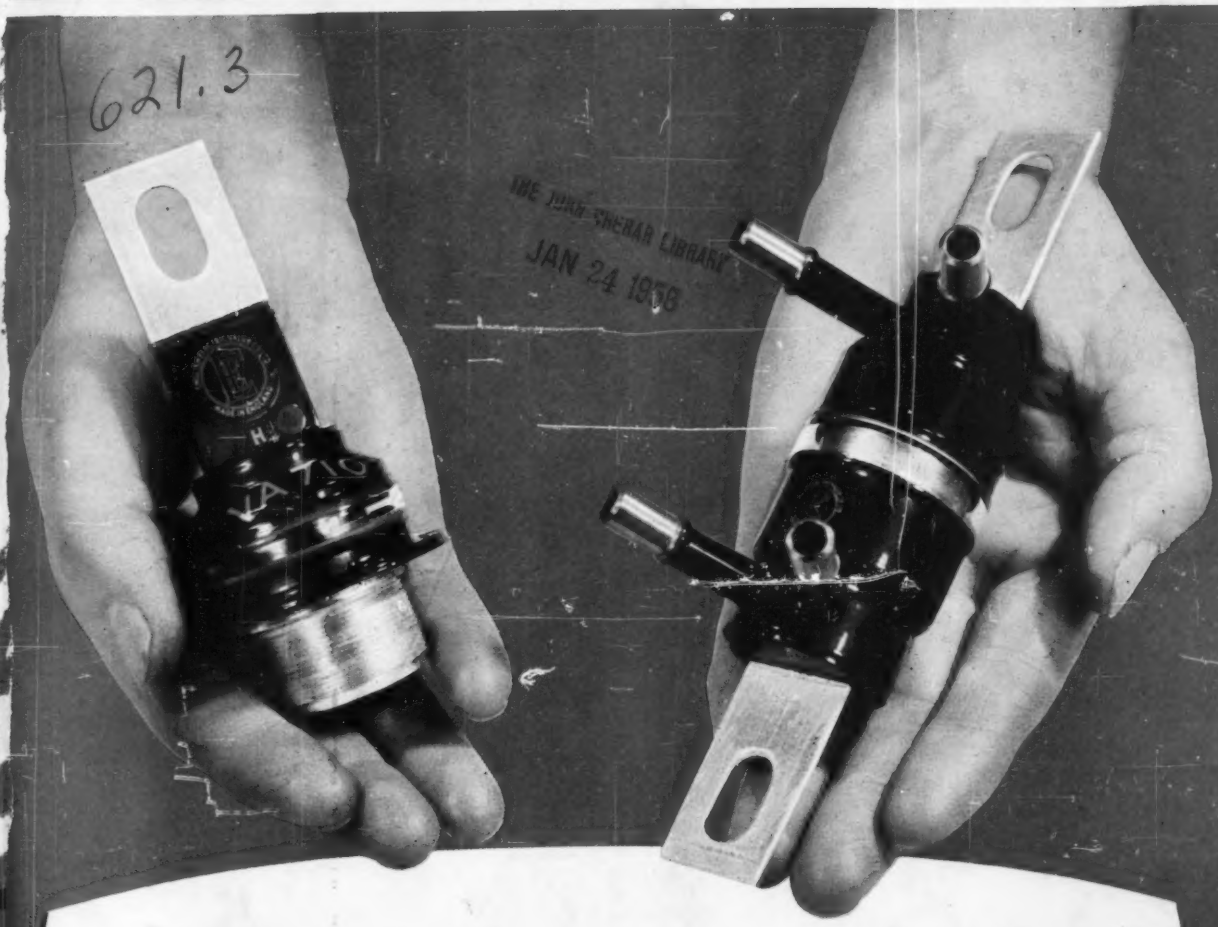
ELECTRICAL REVIEW

JANUARY 1958 PRICE 1s 6d

621.3

IDE JOHN SHERAR LIBRARY
JAN 24 1958



'ENGLISH ELECTRIC'
germanium rectifiers
air-cooled or water-cooled

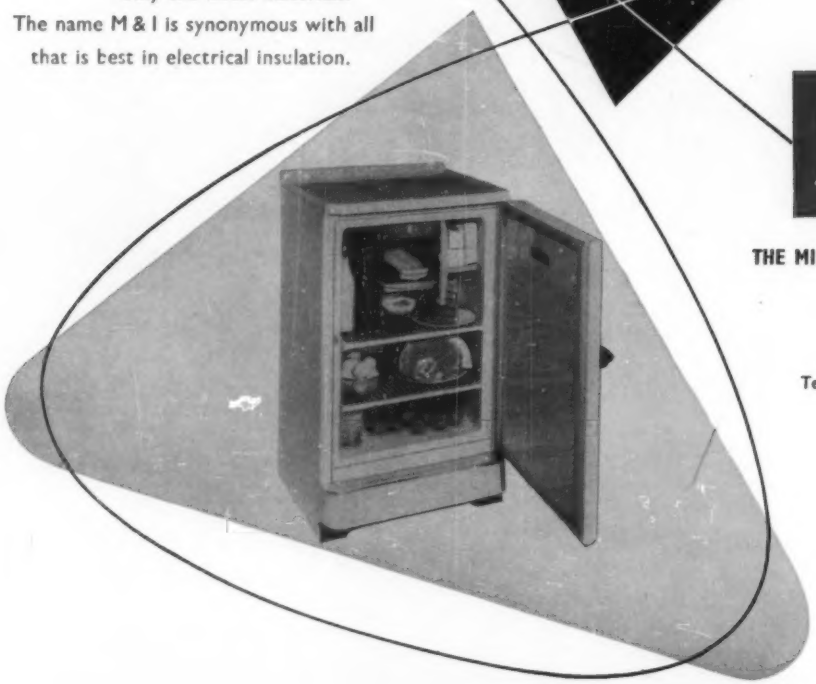
THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2.
Rectifier Substation Department, Stafford.
WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

KGC.2A8

UPPER PHOTOGRAPH by courtesy of Birlec Ltd.
LOWER PHOTOGRAPH Coldrator refrigerator by courtesy of The Hotpoint Electric Appliance Co. Ltd.

M & I PRODUCTS in hot spots and cold places

For safety and efficiency under all conditions it is essential to use only the finest materials. The name M & I is synonymous with all that is best in electrical insulation.

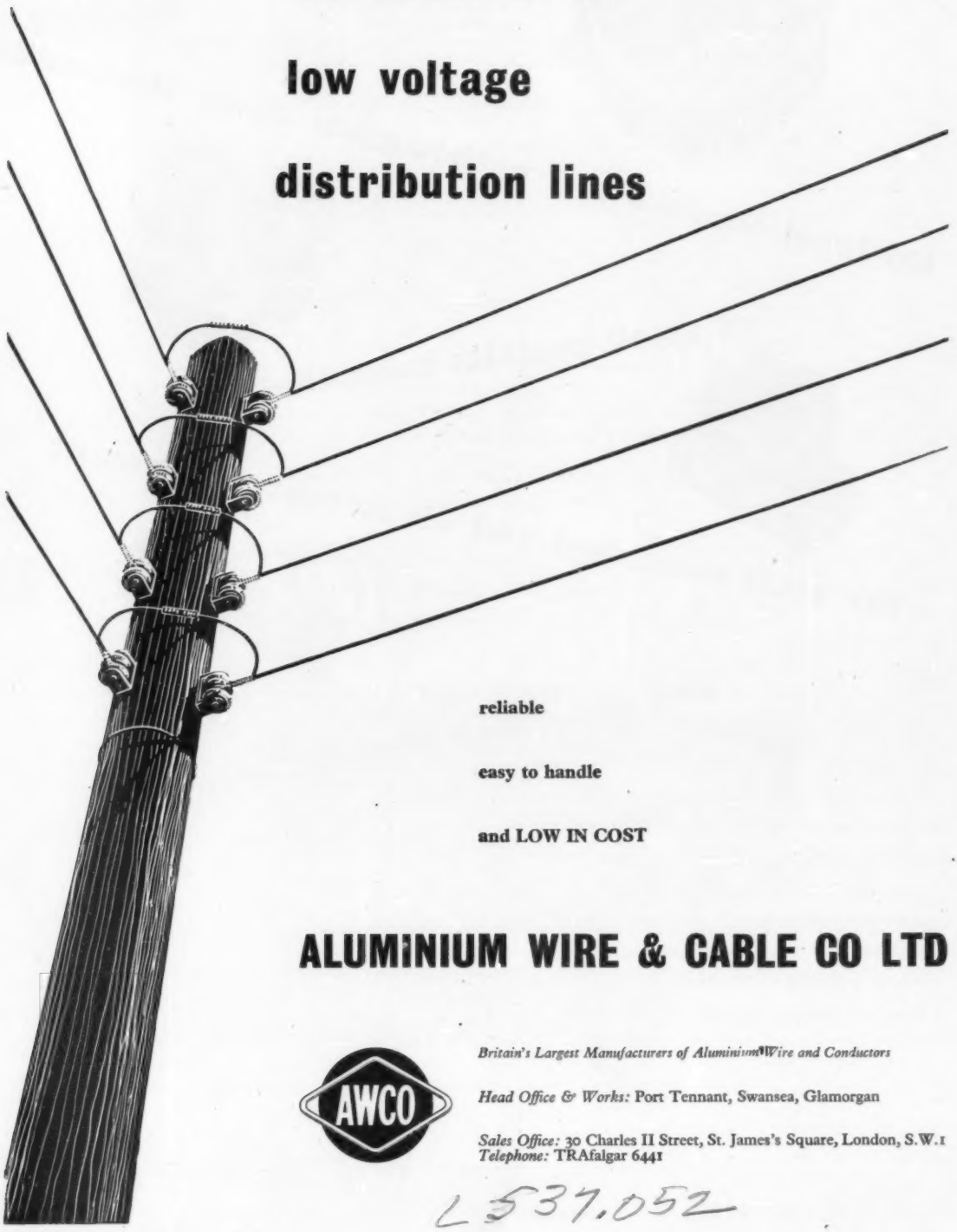


m and i

THE MICANITE & INSULATORS CO., LTD.,
Empire Works, Blackhorse Lane,
Walthamstow, London, E.17.
Telephone: Larkswood 5500.
Telegrams: Mytilite, Easphone, London.

MICA, MICANITE, "PAXOLIN", "PANILAX", EMPIRE VARNISHED INSULATION ON PAPER, CLOTH, SILK, NYLON, GLASS & TERYLENE BASE, SILICONE INSULATION, HIGH VOLTAGE BUSHINGS, FIBROUS MATERIALS, INJECTION MOULDINGS & EXTRUSIONS IN PVC AND OTHER THERMOPLASTICS

All-Aluminium conductors for low voltage distribution lines



reliable

easy to handle

and LOW IN COST

ALUMINIUM WIRE & CABLE CO LTD

AWCO

Britain's Largest Manufacturers of Aluminium Wire and Conductors

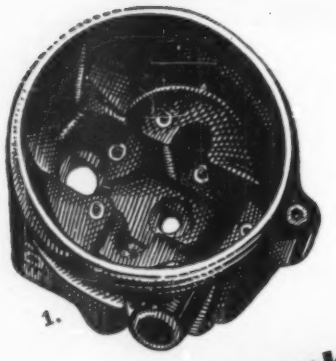
Head Office & Works: Port Tennant, Swansea, Glamorgan

Sales Office: 30 Charles II Street, St. James's Square, London, S.W.1
Telephone: TRAfalgar 6441

A

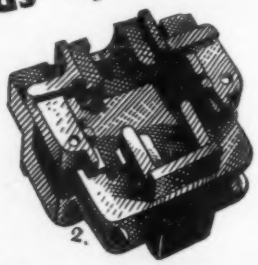
L 537.052
1

NP 60

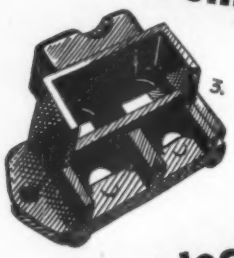

1.

The mouldings illustrated are shown with the kind permission of the following companies :—
1. Mine Safety Appliances Company Ltd.
2. The Plessey Company Ltd.
3. Ranco Ltd.
4. Igranic Electric Co. Ltd.

National Plastics make thousands upon thousands


2.

of small plastics mouldings


3.

for vital electrical and electronic equipment

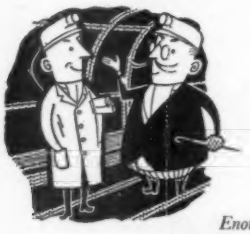
4.

and can make thousands more

The design and manufacture of small mouldings, in large quantities, is just as much a speciality of National Plastics as the production of large and spectacular articles. Indeed, the making of a large multi-cavity mould to produce many small mouldings quickly is often a piece of fine engineering that only specialists can achieve.

NATIONAL PLASTICS

NATIONAL PLASTICS (SALES) LTD. . . . Avenue Works, Walthamstow Avenue, London, E.4. . . . *'phone Larkswood 2323*



But if it's Buxton certified, isn't that enough?

Enough from the safety point of view, yes sir. These Brush Flameproof motors are Buxton certified for Groups 1 and 2 atmospheres. But they are much more besides.

You mean this non-breathing business?

Yes sir. You see, in atmospheres laden with small dust particles, a motor of the conventional flameproof type will inhale dust as it 'breathes'—that is, as the air enclosed by the casing expands and contracts. In a damp and dirty atmosphere a tremendous amount of dirt and moisture is drawn into the machine after 'shut down'. Well, the Brush Non-breathing Type is so designed that the free air space within the casing is reduced to an absolute minimum. So the breathing volume is cut down to the smallest possible level.

And what's the particular advantage?

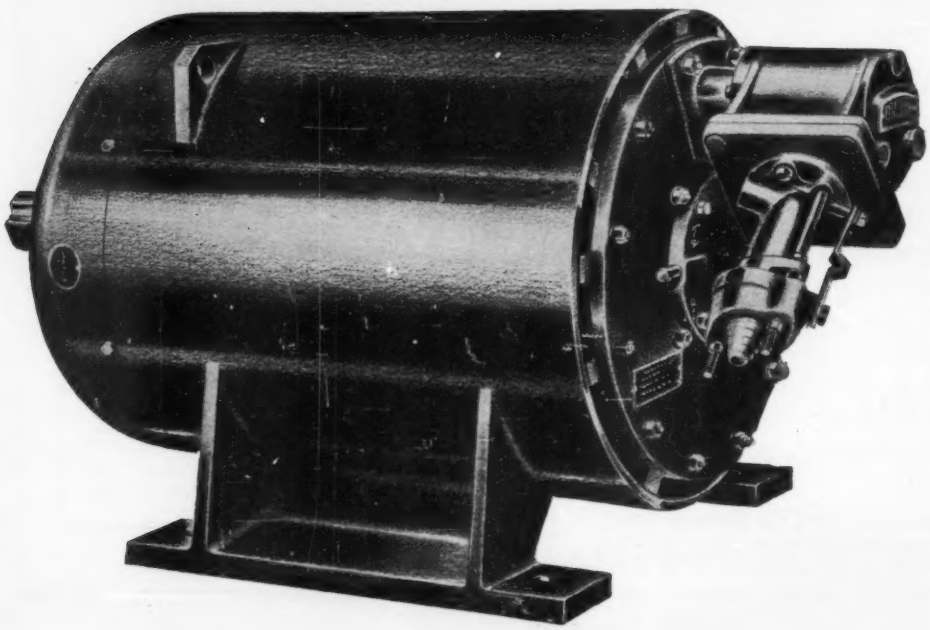
You don't get dirt in the bearings. You don't run the risk of burn-outs due to moisture. So, in such places as coalmines, flour mills, cement works—in fact, any situation where there's a dusty or damp atmosphere —you get trouble-free running of an exceptional order. This means savings on maintenance. And, of course, with the usual Brush reliability . . .

Say no more! That's quite enough to persuade me that the Brush Non-breathing Motor is something we ought to have.

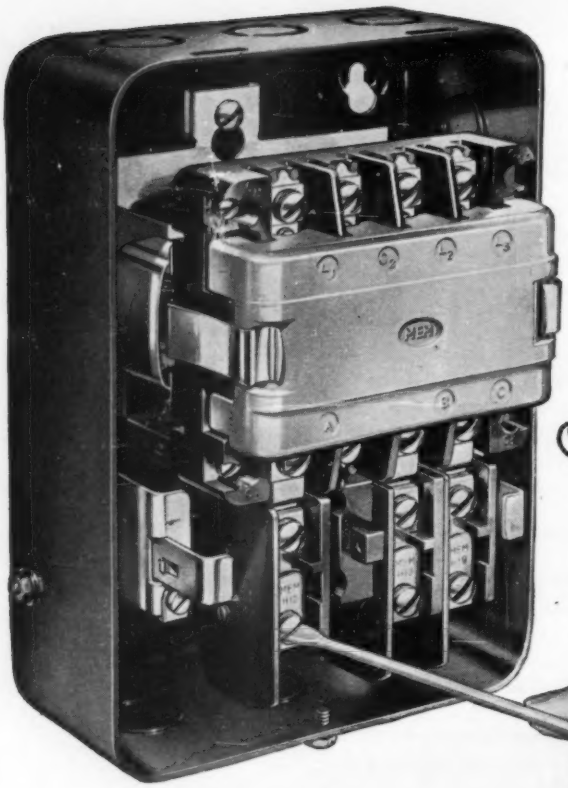
BRUSH

the power people

Write for publication No. 11023/AD to:
BRUSH ELECTRICAL ENGINEERING CO LTD • LOUGHBOROUGH
Member of the Brush Group



E.3



Standardise on MEM 'Autoline' Starters

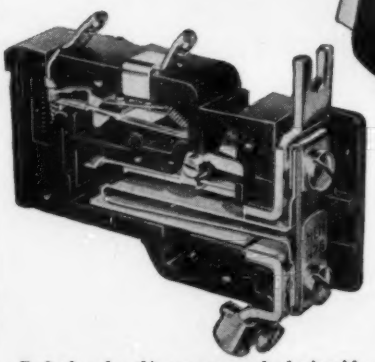
FOR EVERY MOTOR UP TO 15 HP

JUST FIT THE RIGHT HEATER FOR MATCHED OVERLOAD PROTECTION

STOCK the basic MEM Autoline starter and a selection of heaters. When you need a new starter fit the right heater—it's only a moment's work—and you have a starter matched to the duty. You simplify the stores problem and save time and money.

MEM Autoline starters give precision protection for every motor up to 15 HP. This means fewer hold-ups and less loss of plant working time.

Standardising on Autoline starters also makes maintenance easier. All parts are interchangeable. Send for List No. 365(X), describing the Autoline system in detail.



Each phase has this accurate overload trip with a separate switch with solid silver contacts.

MEM MIDLAND ELECTRIC MANUFACTURING COMPANY LIMITED · TYSELEY · BIRMINGHAM 11 · ENGLAND

Finger-tip control of heavy electrical plant

by

B T-H

Leading manufacturers of electric equipment for over half a century, British Thomson-Houston have since the earliest days been foremost in the development of 'finger-tip' control of heavy electric plant through the medium of electro-magnetic contactors.

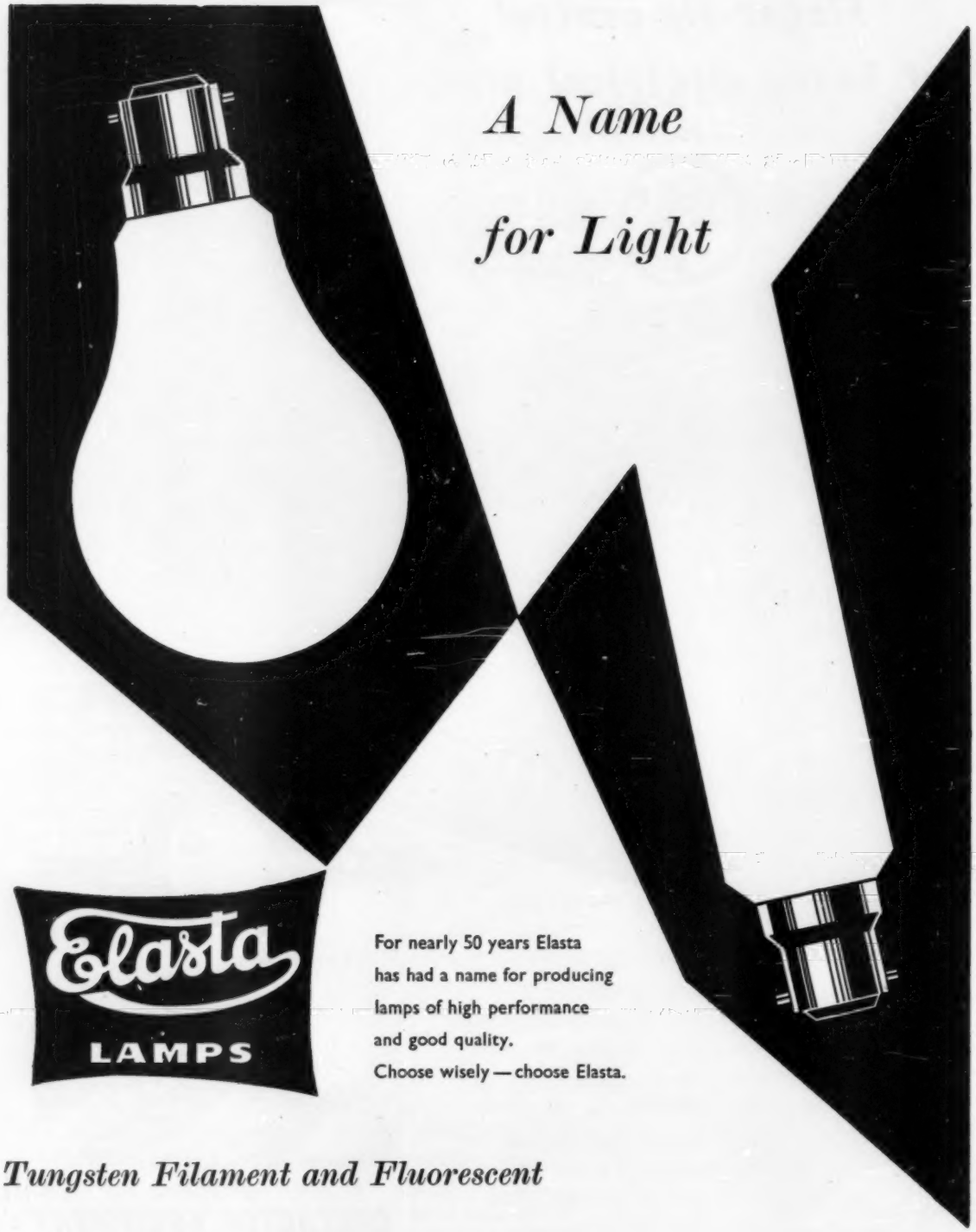
BTH CONTACTOR EQUIPMENT

BRITISH THOMSON-HOUSTON

THE BRITISH THOMSON-HOUSTON CO., LTD., RUGBY ENGLAND

an A.E.I. Company

A5172



A Name for Light

Elasta LAMPS

For nearly 50 years Elasta has had a name for producing lamps of high performance and good quality.
Choose wisely — choose Elasta.

Tungsten Filament and Fluorescent

POPE'S ELECTRIC LAMP CO. LTD., *Head Office: 5 Earnshaw Street, New Oxford Street, London, W.C.2*

Branches: Manchester, Leeds, Leicester, Birmingham, Bristol, Belfast (Northern Ireland)

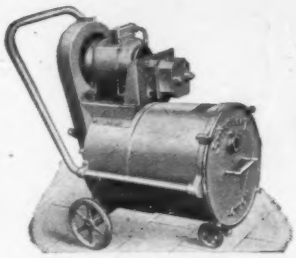
STURTEVANT INDUSTRIAL VACUUM CLEANING

The need for cleaner working conditions has never been so essential and so closely allied to increasing output and quality, as it is today.

The high efficiency of Sturtevant Portable Vacuum Cleaning machines will meet the full surface cleaning requirements in factories of all types — collecting dirt, dusts, powders, granular materials, spillage, fly and swarf.

In addition, Sturtevant portable machines are very strongly constructed to withstand the wear and tear of arduous industrial duties. For further details please write for our **publication U/50007B.**

No. 6X—A very powerful two operator plant with a vertical filter having a capacious removable dust bin.



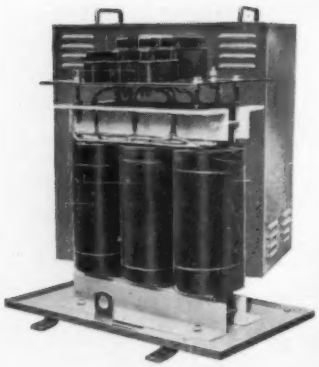
No. 5MT — Fitted with a three phase squirrel cage motor for continuous heavy duty operations.

No. 4X — Particularly suited for the reclamation of granular materials and coarse spillage as it is fitted with a removable metal interceptor bin.

STURTEVANT ENGINEERING CO. LTD.

Southern House Cannon Street London E.C.4

AUSTRALIA: STURTEVANT ENGINEERING CO. (AUSTRALASIA) LTD. 400 SUSSEX STREET SYDNEY N.S.W.



Quality Transformers
for all purposes
in silicon steel, grain oriented steel,
"C" cores, "E" cores to
BRITISH STANDARDS SPECIFICATIONS
Chokes — Reactors

AIR COOLED

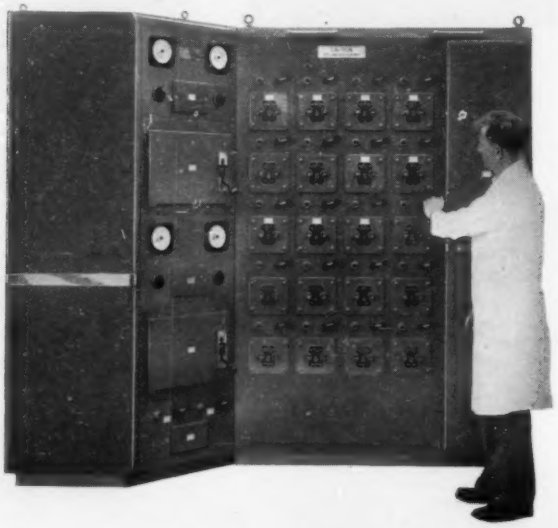
TRANSFORMERS

Delivery to customers' requirements

Special department for prototype work

Also Manufacturers of
CONTROL PANELS
FUSEBOARDS
A.C./D.C. UNITS
POWER PACKS
DISTRIBUTION BOARDS
FOR SPECIAL PURPOSES

Wiring of customers' own equipment



A section of a typical Control Panel made recently

On Post Office and Ministry of Supply Lists
Approved by C.E.A.

EXPRESS WINDING CO.

44-46 Beddington Lane, CROYDON, Surrey

Telephone : Thornton Heath 2443-4

Know how . . .

When it comes to electrical repairs, the expression 'know-how' means a great deal of accumulated experience in an endless variety of applications. Added to that must be equipment and facilities on a large scale and test instruments of every kind. And if you multiply all that by fourteen works you have the B.E.R.L. Service Organisation—the largest electrical repair company in Great Britain.

B.E.R.L.

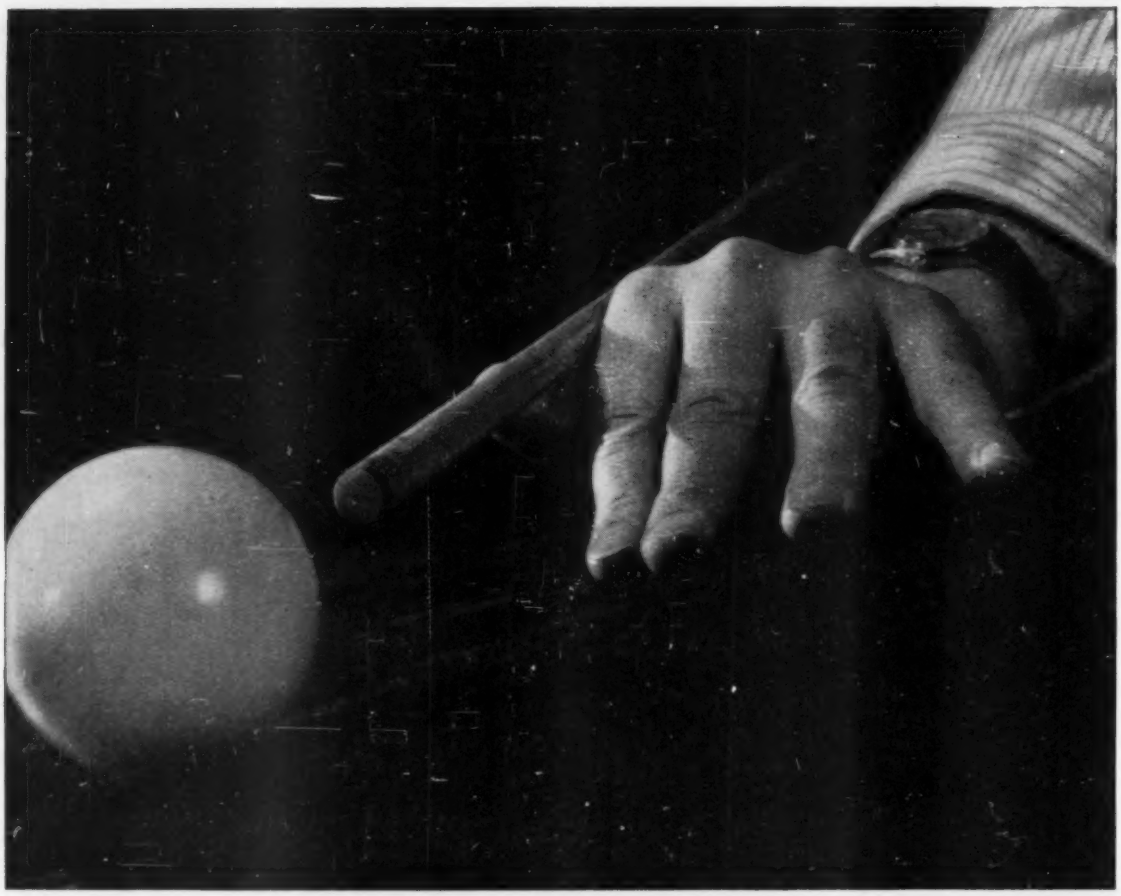
BRITISH ELECTRICAL REPAIRS LTD

Empire House, Charlotte Street, Manchester 1

Works at :

Bath Birmingham Cardiff Chesterfield Edinburgh Glasgow
Hawick London Manchester Newcastle Swansea

dm BER 66



A kind of mathematics that plays a part in making electric cables.

Given the elasticity and weight of the balls, the resilience of the cushion, the rolling friction of the cloth, it must be possible for a billiards player to calculate exactly where and how hard to strike the cue ball. But you never see him doing sums. Somehow his knowledge is instinctive, the result of much experience.

Similarly it ought to be possible to specify a product such as cable. Perhaps it is. But in practice, as everyone knows, it doesn't work like that: manufacture involves hundreds of decisions that are made on experience. Like the expert billiards player, a Company with years at the job is able to sum up rapidly and almost unconsciously the combined effect of a large number of variables: it has, in fact, something analogous to his 'skill', which comes out in the quality of its products.

That's why the name on a product can mean so much.

Crompton

ELECTRICAL EQUIPMENT

A GOOD NAME FOR CABLE

Made to the registered specifications of the Cable Makers Association

CROMPTON PARKINSON LIMITED, CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2. CABLE WORKS : ALFRETON ROAD DERBY. TEL. : DERBY 45431

'Erskine Heap' installation at

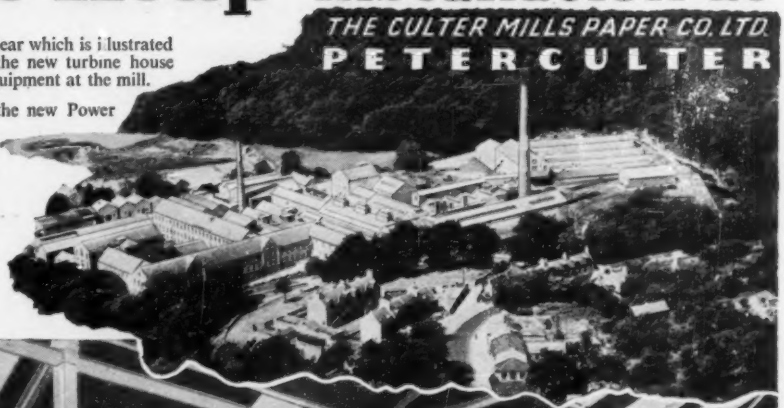
THE CULTER MILLS PAPER CO. LTD. PETERCULTER

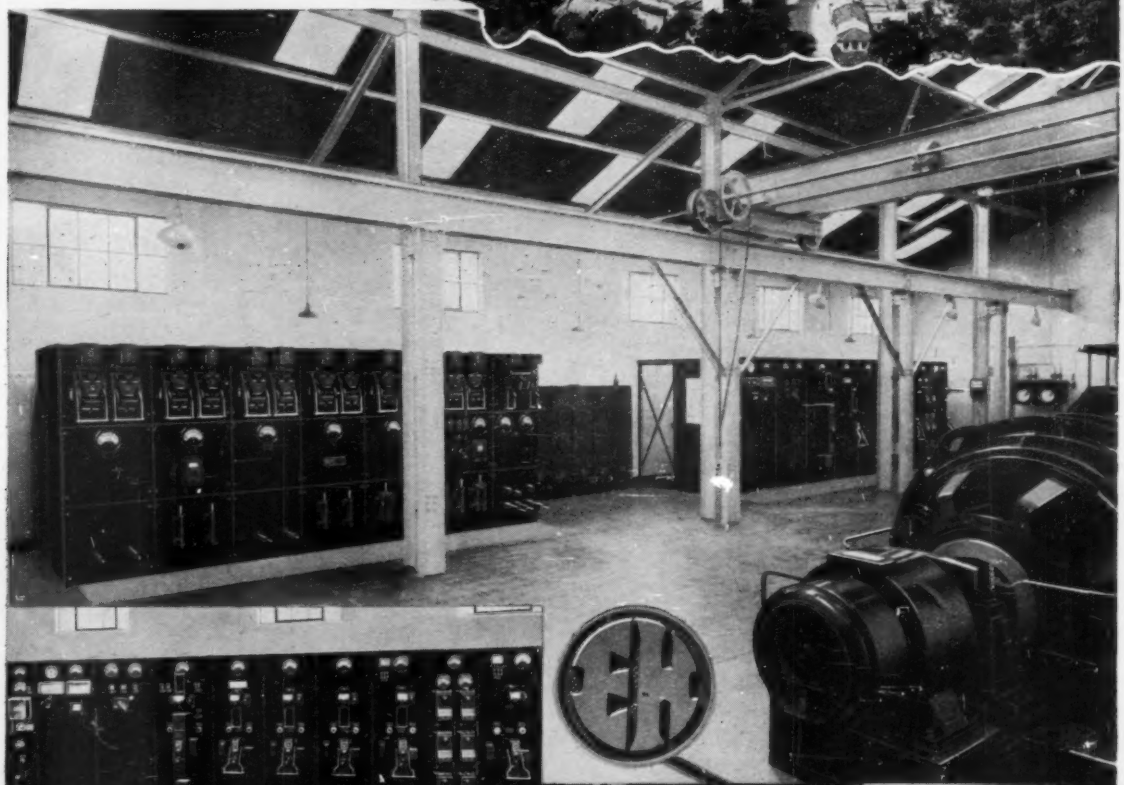
The Switchgear and Motor Control Gear which is illustrated below is part of the installation of the new turbine house and modernisation of the electrical equipment at the mill.

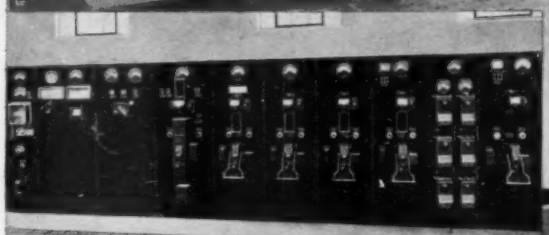
The large centre illustration shows the new Power House with the A.C. and D.C. Switchgear for controlling the 2400 KW Alternator and the 850 KW D.C. generator of the new turbine set.

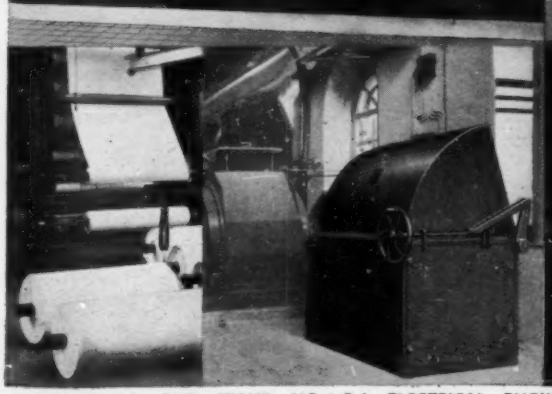
In the lower illustrations are other switchboards and motor control gear typical of those throughout the mill.

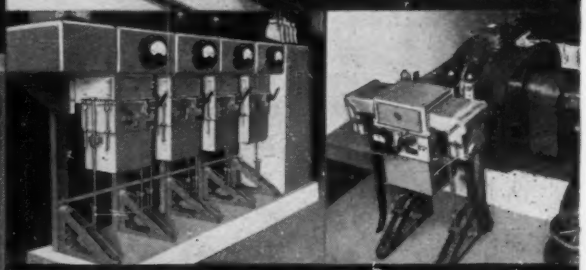
Consulting Engineer, A. B. Mallinson, M.I.Mech.E., M.I.E.E.











ERSKINE, HEAP & Co. LTD

SWITCHGEAR SPECIALISTS

Head Office & Works BROUGHTON, MANCHESTER (7)

London Office GRAND BUILDINGS, TRAFALGAR SQ., W.C.2

BRANCH OFFICES AND AGENCIES IN ALL PARTS OF THE WORLD

WELCOME TO OUR STAND NO. 0.4, ELECTRICAL ENGINEERS EXHIBITION, EARLS COURT, LONDON. MARCH 25–29

212

CROYDON

Precision Power Motors

JA Frame for Shaded Pole, Synchronous or Squirrel Cage Induction Motors.

Over 30 years' specialised knowledge and experience are behind the development of the present range of CROYDON F.H.P. Motors.

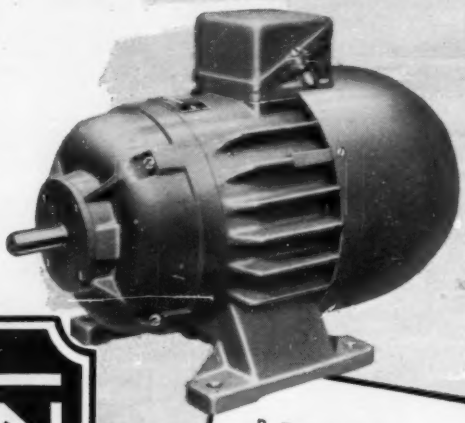
F.H.P. Motors for

Air Conditioning Equipment, Business Machines, Chemical Plant, Control Devices, Electronic Equipment, High Frequency Blowers and Fans, Radar Aerial Drives, Servo Controls and many other applications.

Also complete Alternator Sets (including High Frequency Inductor Alternators), Brake Motors, D.C. Centrifugal Blowers, Generator Sets, Gear Units, Polarised Synchronous Units, Governed Machines, Rotary Convertors and Torque Motors.

JA Frame, 2-speed Synchronous Hysteresis Motor.

If you have a Motor Problem Consult



P Frame, Totally Enclosed Externally Cooled Motor. Range up to 2½ H.P.

CROYDON

THE CROYDON ENGINEERING CO. LTD.

COMMERCE WAY, PURLEY WAY, CROYDON

Telephone: CROYDON 4125/6/7/8 *Telegrams:* SYNCROY, CROYDON

PLASTICS
ELO
PRODUCTS

BIRKBYS LTD. LIVERSEDGE, YORKSHIRE
London Office :- 79 Baker Street W.1.

L.E.F. ELECTRIC WINCHES
portable & self-contained

After using one of these L.E.F. electric winches, Metropolitan Vickers Co., Ltd., of Manchester, found it so satisfactory that they placed an order for three more.

Portable, self-contained and capable of handling loads of up to 2½ tons, these winches are made with the skill and precision which characterises all L.E.F. winches.

Send for details of standard equipment or we shall be glad to manufacture to your special requirements.

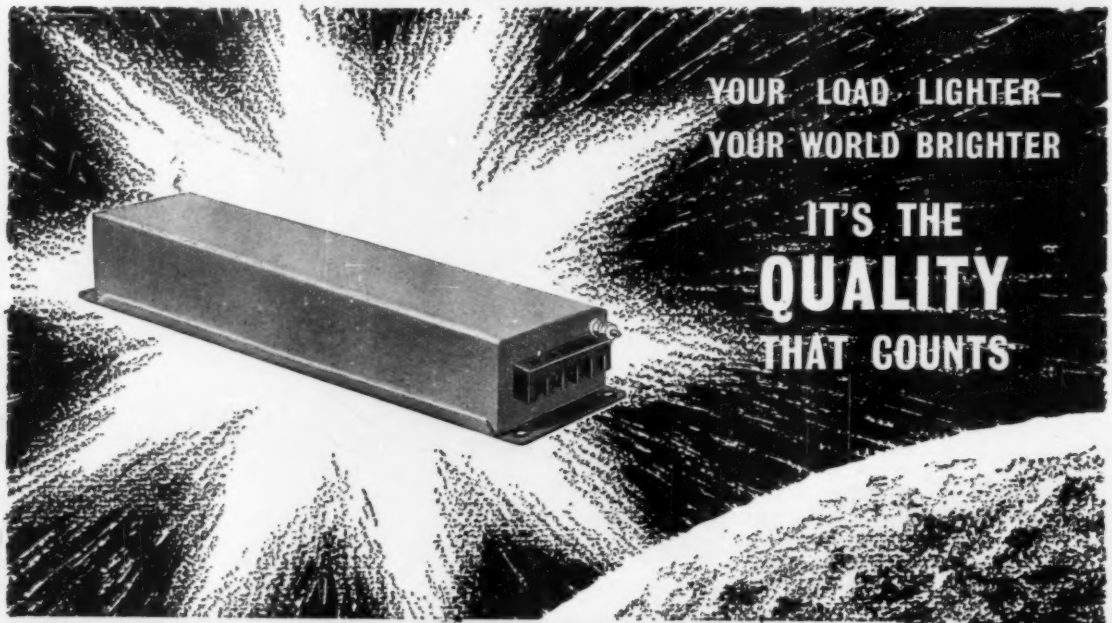
London Electric Firm Ltd.

Brighton Road, South Croydon, Surrey

Telephone: Uplands 4871

L&F

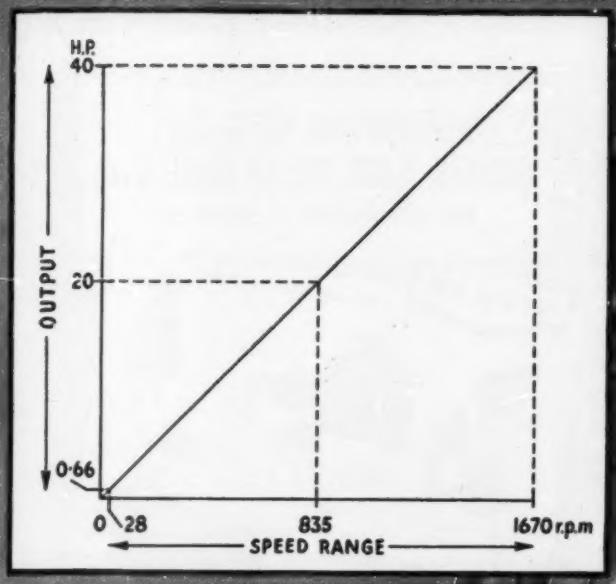
Tib. 97

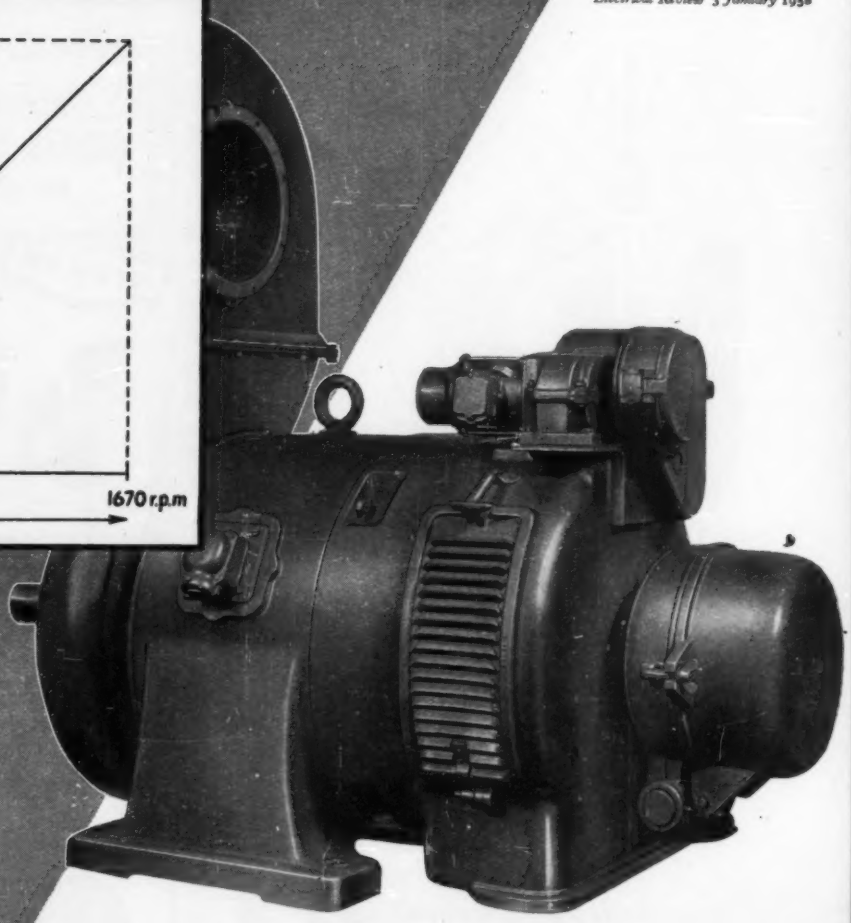


CONTROL COMPONENTS LIMITED

CROFT WORKS, MOORE PARK ROAD, LONDON, S.W.6 • Phone: RENOWN 7181—5 lines

Manufacturers of High Grade Fluorescent Control Gear





Variable Speed A.C. COMMUTATOR MOTORS

It is not perhaps widely known that a very wide speed range of 60 : 1 is possible with large FULLER Variable Speed Commutator Motors. The graph shown above indicates the output speed ratio from a *standard design* motor of 40 h.p. rating operating on three phase 415 volt 50 cycle supply.

Plant engineers will appreciate the important advantages of obtaining this wide control from crawl to full speed using a single motor with either hand or automatic push-button control.

FULLER'S unequalled experience, over 46 years, in the design of these motors has enabled us in the past to provide special motors with 60 : 1 speed range but this performance is now possible with standard frame sizes.

You are invited to apply for further details of these motors given in our Pamphlet No. 7315E.

FULLER ELECTRIC

FULLER ELECTRIC LIMITED

FULBOURNE ROAD, LONDON, E.17

Phone : LARkswood 2350 (10 lines)

ALSO AT: **BIRMINGHAM : GLASGOW : MANCHESTER**

his dad uses
DECO
cable reeling drums
too!

send for a copy of this brochure which deals comprehensively with the subject

RANGE OF DECO EQUIPMENT INCLUDES

Special Electrical Equipment for every class of Handling Plant. Winch Limiting Mechanisms with special quick reset features, Shunts and Ultimate Series Type, Float Controls.
Contact Collector Columns for all classes of Cranes, Slurries, Turntables, Mixers, etc. Emergency chain and wire operation system trip switches. Centrifugal Switches. Special limit and control switches, push buttons and auxiliary devices for automatic operation of Material Handling Plants.
"DECO" patent Hose Reeling Drums, Patent No. 370,076/32, for use with Fluids, Overhead collector equipment up to 650 volts D.C. 6,600 volt Reeling Drums for special applications.

ASSOCIATED COMPANY
GRILL FLOORS LTD
manufacturers of:
Grill Floors for Platforms and Mezzanine Floors, Steel Lattice Ladders, Patented Hand Railing, Grills for Coal Screens, Access Ladders with Convex Visible Edge Stairtreads, Window Cleaning Galleries, Trench Gratings, Duckboards, Servo Docks, Vehicle Washes, Scaffold Boards.

DECO ENGINEERING Co Ltd
WEST ROW NORTH KENSINGTON LONDON W10
Telephone LADbroke 3066/7 Telegrams ETYLADEC WESPHONE LONDON
P464

WEATHERPROOF METAL-CLAD SOCKETS, PLUGS, SWITCH SOCKETS etc.
for all electrical purposes

REGD TRADE MARK **NIPHAN** 5-300 amp. 250-500 Volt

Plug
C.I. Switch Socket and Cover
Flange Socket with Cover and Plug
C.I. Terminal Socket and Cover with through sealing chamber and glands for cable
Through Angle Flange Socket with Cover and Plug

SIMMONDS & STOKES (NIPHAN) LTD
MANUFACTURING ELECTRICAL ENGINEERS
Victoria House, Southampton Row, London, W.C.1. HOLborn 2163, 8637

INSULATING SHROUDS FOR LINE TAPS
TO B.E. SPECIFICATION

HOME AND EXPORT ENQUIRIES INVITED

Plastic Mouldings
PHENOLIC AND UREA

T. BLACKWELL & SON LTD. *Phone: Waltham Cross 2430*
Brooker Road, Waltham Abbey, Essex

TRANSFORMERS of all types up to 25 kVA for Single or Three Phase operation, Phase Conversion, etc.

INDUCTA

COILS for Contactors, E.M. Brakes, Air Valves, etc. and COIL WINDINGS for all purposes.

MAINS Output, and Special Purpose Transformers for Radio Equipment, Chokes, etc.

SOLENOIDS for A.C. and D.C. Operation A.I.D. APPROVED

W. F. PARSONAGE & Co LTD
INDUCTA WORKS
PARK RD BLOXWICH WALSALL
TELEPHONE: BLOX. 66464

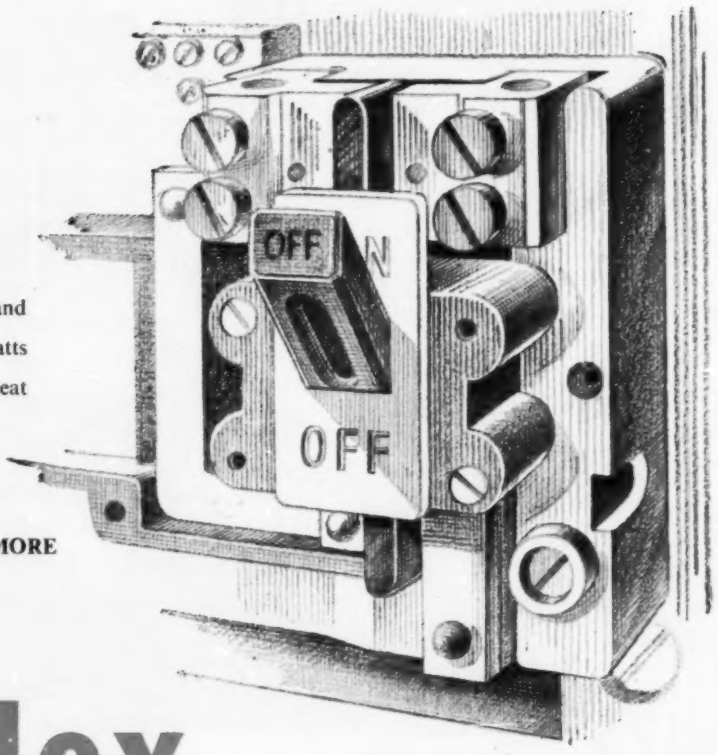
"Little Things mean a lot"

WYLEX
SOLID LINKS

from switch to neutral bar and bus bar. This gives low watts loss, as well as making a neat and tidy job

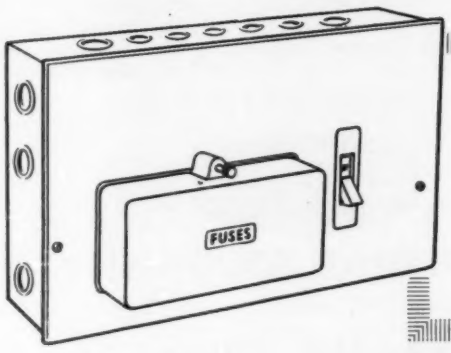
One of the little things that make Wylex Units

WORTH A LOT MORE



Wylex

Switch Fuse Control Units



ALL-INSULATED (Brown & Cream)
1, 2, 3, 4, 6, 8 WAYS

METALCLAD (Brown only) 3, 4, 6, 8, WAYS

ANY COMBINATION OF 5, 15, and 30 amp. Fuses

Rewirable or H.R.C. Cartridge

GEORGE H. SCHOLES & CO. LTD., WYLEX WORKS, WYTHENSHAWE, MANCHESTER 22

A*

H.M.T.S "MONARCH"

The Transatlantic Telephone Cable

"In every phase of this combined operation use has been made of the best that was available for the job . . ."

"Construction of the Repeaters on both sides of the Atlantic, aimed at achieving as near perfection as humanly possible: if one of them fails, communication will stop . . ."

Sir Gordon Radley, K.C.B., C.B.E., Ph.D.(Eng.), M.I.E.E.
Director General, United Kingdom Post Office.

Photograph by courtesy of Standard Telephones and Cables Ltd.

Covered by British, Foreign Pats. and Reg. Designs, etc. Complying with leading countries' electrical standards.

THE 16 Submerged Repeaters in the Transatlantic Telephone submarine cable section between Newfoundland and Nova Scotia had to be built to withstand the rigours of laying and water pressure at depths of up to 250 fathoms under the Atlantic, with components of such fidelity as to last many years without attention.

Each Repeater contains 299 separate components and required 1,950 SOLDERED JOINTS to connect them together and each joint was inspected at some stage of production and marked to indicate that it had been inspected and accepted.

The Repeaters for the Clarenville to Sydney Mines cable were made in the Standard Telephones and Cables factory at Woolwich, London.

High fidelity in components, skill and craftsmanship was well matched with—

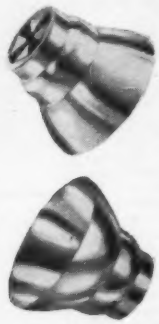
ADCOLA

SOLDERING EQUIPMENT

Write for Catalogues
HEAD OFFICE AND SALES

ADCOLA PRODUCTS LTD.
Gauden Road, Clapham High Street, London, S.W.4
Telephone: MACaulay 3101—4272

Another ALUMINIUM REFLECTOR in the STOCKFIELD range



★ Our SP/1 Reflector spinning in super purity aluminium, electro-brightened to give very high reflectivity.

Spinners to the Trade

STOCKFIELD MFG. CO. LTD.
23 Stockfield Road
BIRMINGHAM 27

Telephone : Acocks Green 2931

MERCURY SWITCHES

THE MERCURY SWITCH MANUFACTURING COMPANY LIMITED are the largest specialised manufacturers of Mercury Switches in Great Britain. These are made to exceptionally high and uniform standards of quality.
Since its inception in 1932, this Company has concentrated solely on the production of Mercury Switches. It has thereby obtained the widest possible experience and expert knowledge of design, manufacture and application.

THE MERCURY SWITCH MANUFACTURING CO. LTD.
WEST DRAYTON - MIDDX.

MS11

The Superlative SONISCOPE Regd
ELECTRONIC STETHOSCOPE

The performance of this instrument is so remarkable it must be heard to be believed

Here is the SONISCOPE, an outstanding achievement in *three* techniques — miniaturisation, electronics and acoustics. In sensitivity and selectivity, range and amplification, its performance goes far beyond any previously known standards and would be remarkable even in an instrument of normal size. By registering the sounds, vibrations and rhythms of machinery, electrical plant and pipelines, the SONISCOPE has no equal in discovering the most minute imperfections.

● Infinitesimal sounds are amplified literally thousands of times with negligible distortion.

● Vibrations in the region of minus 60 decibels can be amplified and clearly distinguished.

● Over a range of 25 to 20,000 c.p.s. the required frequency can be isolated from unwanted frequencies by adjustment of the attenuators.

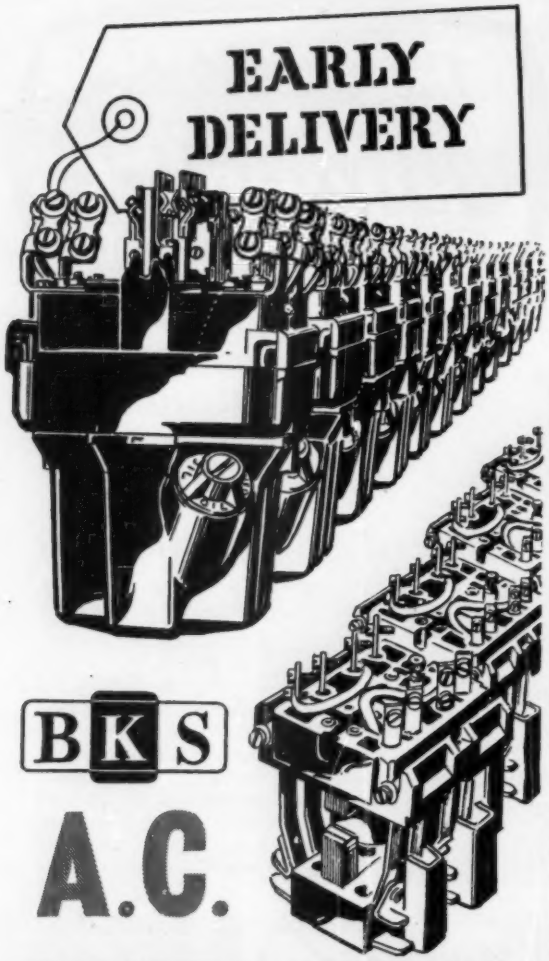
● There are *twin* inputs and outputs. Two sets of stethoscopes can be used or a single set combined with measuring and recording instruments—even a special loudspeaker.

● Size 4¾" x 3¼" x 1⅞". Battery operation.

Please ask for further particulars

AIRSONIC LTD.
Dept. E/3, 14 OLD QUEEN STREET, LONDON, S.W.1
Telephone: TRA*falgar* 2255/6/7

FE5



BKS

A.C.

CONTACTORS

for the control of heating, lighting, distribution and motors

ALL STANDARD VOLTAGES

We are in a position to offer early delivery of the undermentioned Contactors. They can be supplied as units only for building in, or complete in housings for wall mounting.

Type D1 10 *amp.* 15 *amp.* 30 *amp.—Air break. T.P. and D.P.*
Type D10 15 15 *amp. oil immersed—T.P. and D.P.*
Type D10 60 60 *amp. Heavy duty 4 Pole T.P. and D.P.*
100 *amp. Heavy duty T.P. and D.P.*

BRITISH KLOCKNER SWITCHGEAR LTD

Head Office and Works: **CHERTSEY, SURREY**
Telephone: Chertsey 2067. *Telegrams: Switchgear, Chertsey*
SALES OFFICES:
MANCHESTER 4: Cromford House, Cromford Court. Telephone: Blackfriars 3903.
GLASGOW: 249 St. Vincent Street. Telephone: Central 2479.
NEWCASTLE: 4 Beechwood Avenue, Monkseaton, Whitley Bay, Northumberland. Telephone: Whitley Bay 24231.
BIRMINGHAM: 190 Aldridge Road, Streetly, Staffordshire. Telephone: Streetly 1641.
Subsidiary of Dorman Smith Holdings Limited

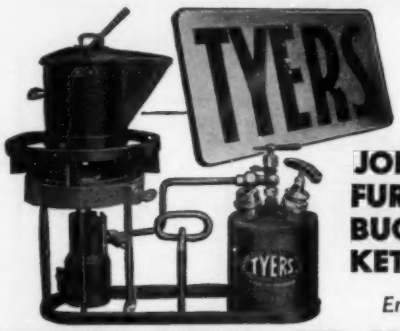
A new edition of Professor Cotton's famous work

ELECTRICAL TECHNOLOGY
(M.K.S. UNITS)

By H. Cotton, M.B.E., D.Sc., M.I.E.E. Here is an entirely revised and reset seventh edition of this standard work. Apart from its unquestioned value for university engineering degree students, it will also be useful to those taking a Higher National Certificate, City and Guilds and I.E.E. exams. In this new edition the M.K.S. system is adopted throughout but the sixth edition will still be available for those who prefer C.G.S. units. This new edition now forms what is probably the best and most comprehensive general coverage of the subject.
From booksellers, 50/- net.

Parker St., Kingsway, London, WC2

PITMAN
TECHNICAL BOOKS



MADE IN SIX SIZES

JOINTERS' FURNACES, BUCKETS, KETTLES, etc

Enquiries to
PORTABLE FURNACE AND PATENTS CO
Carrington, Nottingham, England — *Phone 64887*

60 YEARS OF CABLEMAKING

Specialist Manufacturers of
FLEXIBLE CABLES & CORDS
to B.S.S., G.D.E.S., etc., specifications

TRADE MARK ESTD. 1898

Lighting, Power, Dynamo, Lifts, Welding and Trailing, V.I.R. and T.R.S., Asbestos and Flame-Resisting, Enamel, Silk, Cotton and Glass Insulated Wires, Bare Copper Braids, Non-Rubber Flexibles, Plaited Copper Braids and Cords, P.V.C.-Polythene, P.V.C.-Microphone, Screened, Armoured, etc.

SAXONIA
ELECTRICAL WIRE COMPANY LTD.
Contractors to the Admiralty, War Office and Air Ministry, etc.
Offices and Works: **ROAN WORKS, GREENWICH, S.E.10**
Grams: "SAXONIST, LONDON." Phones: GREenwich 0463 & 1672
"GREENWICH" CABLES AND FLEXIBLES

Thorn

ANNOUNCE THE SUCCESSFUL PRODUCTION OF THE

ELECTROLUMINESCENT INDICATOR BLOCK
with power pack *(if required)*

New · Space-saving · Economical

The essential component for MULTI-INDICATOR panels and banks of indicators

For those planning assemblies requiring banks or panels of illuminated indicators, here is the ultimate in simplification, space-saving and economy. The newly developed Thorn Electroluminescent block which has overall dimensions of only $2\frac{3}{16}'' \times \frac{1}{2}'' \times \frac{5}{16}''$ contains five electroluminescent areas each with its separate contacts. These blocks can be assembled in great numbers and only occupy a fraction of the present space utilised by lamp indicators.

POWER PACK Transistor power packs can be supplied as a complete installation if required.

Full information available now from:
AIRCRAFT COMPONENTS DIVISION · THORN ELECTRICAL INDUSTRIES LIMITED
GREAT CAMBRIDGE ROAD · ENFIELD · MIDDLESEX · TEL: ENFIELD 5353

Wholesalers for most things Electrical—all of good quality

Contact
DONOVANS
for all WHOLESALE INDUSTRIAL Electrical Supplies

Prompt deliveries by our own Vans in the MIDLAND AREA.

In addition to the goods illustrated, we also supply **CONDUIT (Rigid and Flexible); CONDUIT FITTINGS; LAMPS and FLUORESCENT TUBES; LIGHTING REFLECTORS; PORTABLE TOOLS; SWITCHGEAR and MOTOR CONTROL GEAR.**

We are also Distributors for—
REYROLLE PLUGS and SOCKETS; VENNER TIME SWITCHES; HOOVER F.H.P. MOTORS; CHILTON, E.M.I. & VENNER ELECTRONICS.

THE DONOVAN ELECTRICAL CO. LTD. (WHOLESALING DIVISION)
70-82 GRANVILLE STREET, BIRMINGHAM 1 (LONDON DEPOT: 149-151 YORK WAY, N.7)

for
MICA TAPES
INSULATION

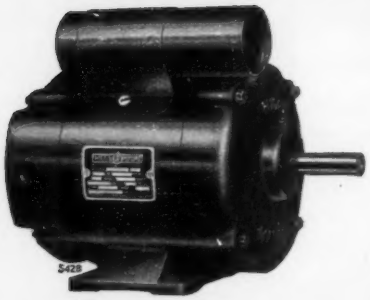
Consult
EAST LONDON MICA WORKS
RINGWOOD RD., WALTHAMSTOW, LONDON, E.17
ESTD. 1912
Phone: COPpermill 2248/9 *Telegrams:* Elmicmer, Easphone, London

TRADE MARK

HIGGS MOTORS LTD.

MANAGING DIRECTOR DAVID C.Y. HIGGS, A.M.I.E.E.

BIRMINGHAM 6 ENGLAND



FRACTIONAL HORSE-POWER MOTORS

Guaranteed for Ever

Belfast • Bristol • Cardiff • Dundee • Glasgow • Hull • Leeds • Liverpool
London • Manchester • Newcastle • Peterborough • Sheffield • Wolverhampton

L&C

AIR INSULATED METAL-CLAD SWITCHGEAR

11 kV - 150 MVA

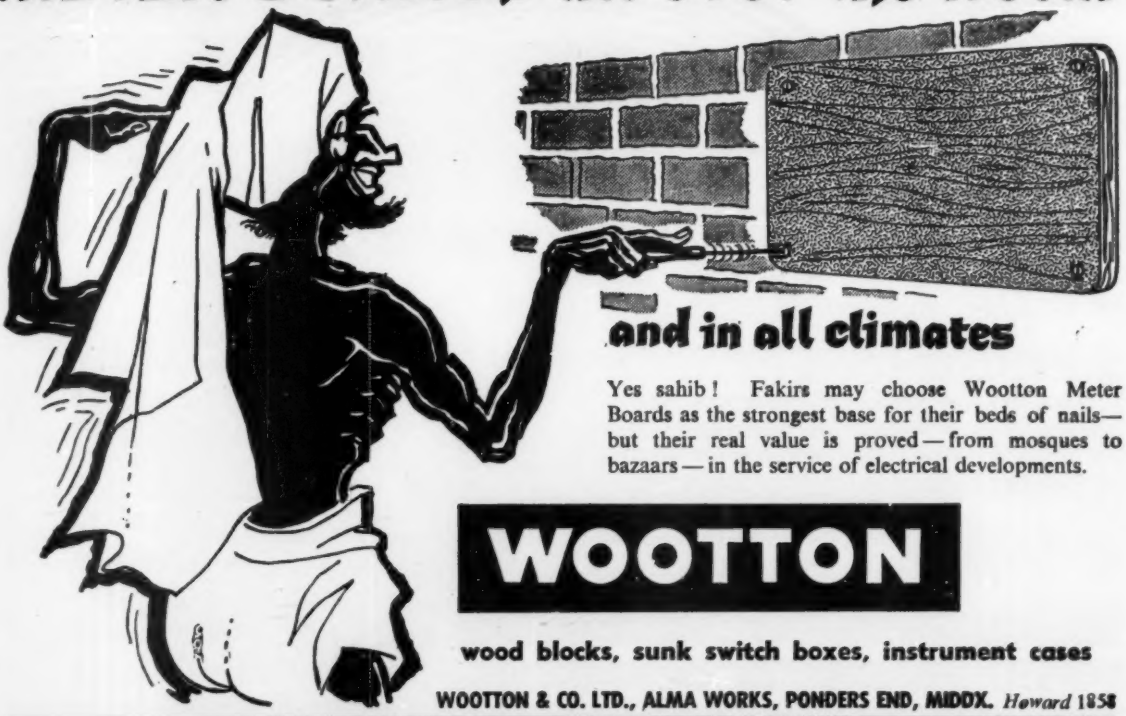
A.S.T.A. CERTIFIED

MADE TO THE SAME HIGH STANDARD AS ALL THE OTHER PRODUCTS OF

LONG & CRAWFORD LTD.

GORTON ROAD – MANCHESTER 12

METER BOARDS all over the world



and in all climates

Yes sahib! Fakirs may choose Wootton Meter Boards as the strongest base for their beds of nails—but their real value is proved—from mosques to bazaars—in the service of electrical developments.

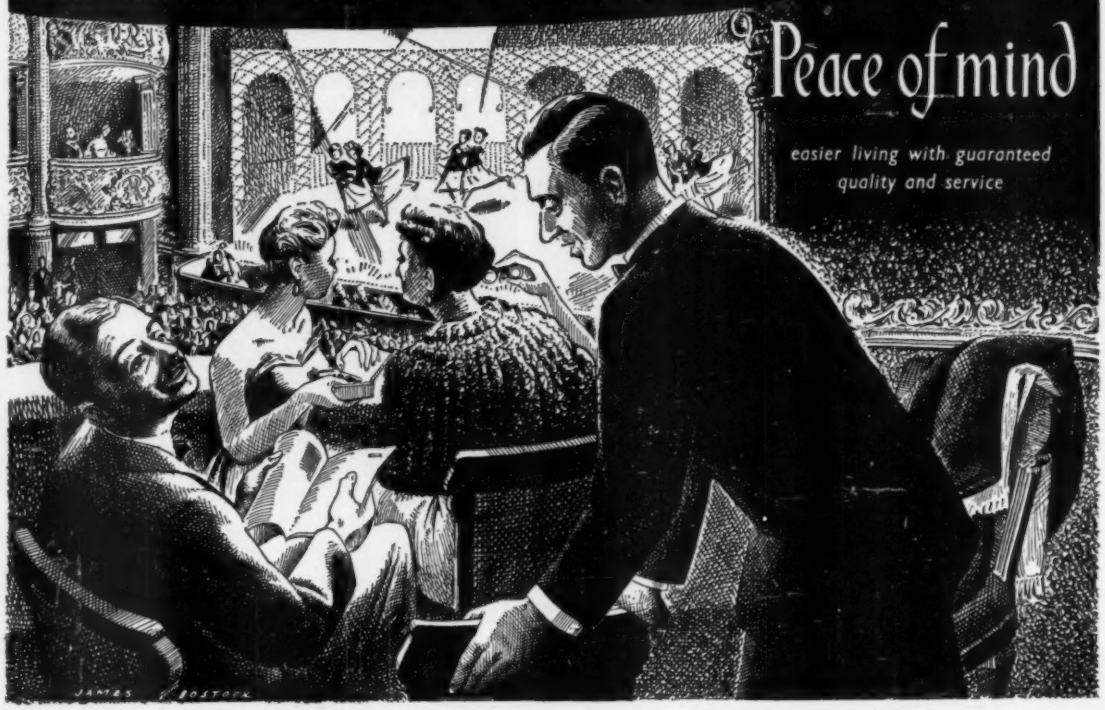
WOOTTON

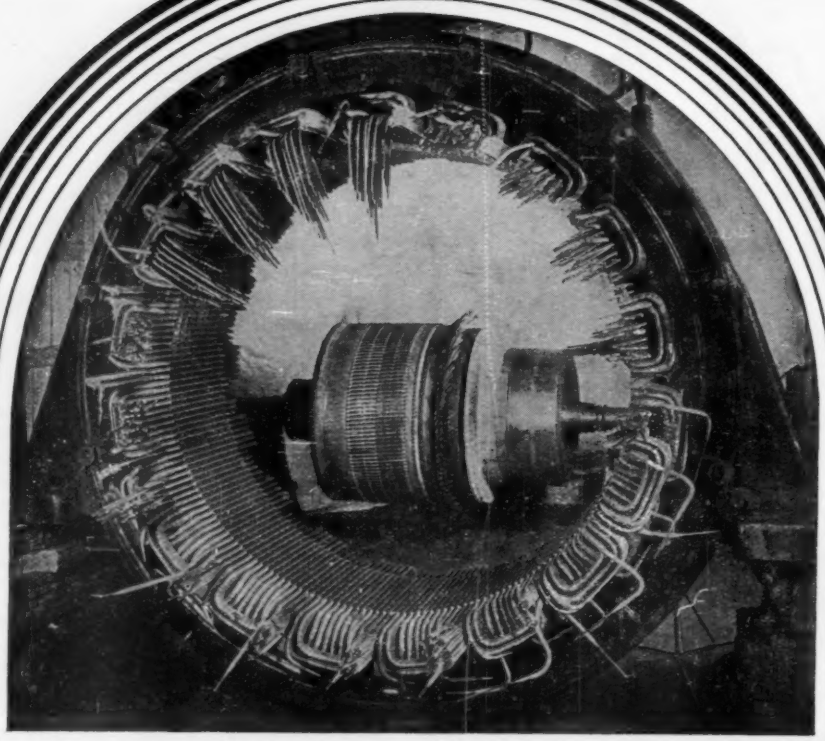
wood blocks, sunk switch boxes, instrument cases

WOOTTON & CO. LTD., ALMA WORKS, PONDERS END, MIDDX. *Howard* 1858

H. ROLLET & Co. Ltd. London, Liverpool, Birmingham, Manchester, Leeds

Rod, Tube, Sheet in Copper, Aluminium, and Alloys since 1896





Variety. Collins' comprehensive experience ensures there is always at least one interesting job going through their works. Here is the stator of a 1250 H.P., 6,600 V., 246 r.p.m. English Electric Motor undergoing complete rewind. In the background is an Armature from a 250 H.P. B.T.H. C.H.T. variable speed motor.

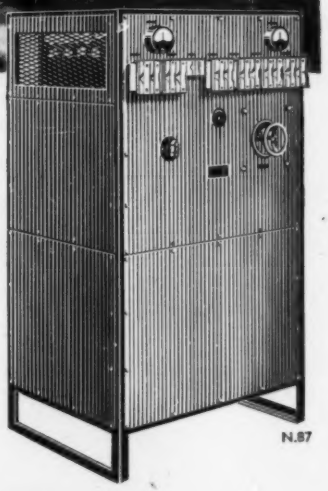
COLLINS

Collins Electrical Ltd.
Head Office 115 Clerkenwell Road London EC1
Central London Works
22 St. Albans Place Upper Street Islington N1
West London Works
9 & 11 Featherstone Road Southall
Phone Holborn 0212-4 Canonbury 3227-8
or Southall 0168

They never let you down

THE ROYAL NATIONAL LIFEBOAT INSTITUTION

Perhaps the greatest of British charities, this famous institution was founded in 1824, and by the time its second report was published had already contributed to the saving of 342 lives. By 1924—centenary year—it had given awards for the saving of nearly 60,000 lives and today that figure stands at over 78,000. At this very moment, all along our coastline, 154 lifeboat crews are ready for the emergency call which means that someone is in peril on the sea. They never let them down.



N.87

YOU CAN BE CERTAIN TOO that Nife-Neverfayle Emergency Lighting Equipment will never let you down. *Whenever* needed, these reliable units will instantly, automatically spring into action. That is the special advantage of the Nife Steel Alkaline Battery—it never deteriorates, even after long periods of inactivity.

Nife-Neverfayle units occupy only one-third of the space required by conventional equipment and, as they can be installed adjacent to other equipment, a separate battery room is not needed—a point worth remembering when planning new buildings. Maintenance costs are negligible—after years of trouble-free service you will realise just how economical your Nife-Neverfayle equipment has been.

NIFE-NEVERFAYLE

THE EMERGENCY LIGHTING EQUIPMENT WITH THE **STEEL** ALKALINE BATTERY

NIFE BATTERIES · REDDITCH · WORCESTERSHIRE

short-handed?

Only *one* pair of hands is required to operate the Azoflex model 42/63 to produce prints in large quantity—dried, flat and ready for immediate trimming and collating. No darkroom, no elaborate ventilating system and ducting are necessary as there are no unpleasant fumes, and therefore AZOFLEX machines are completely mobile to facilitate reorganisation or expansion. Exposing, developing and print delivery are all synchronised for an even flow of finished work, and output in excess of 100 20″×30″ prints per hour can easily be achieved. AZOFLEX is the *only* daylight reflex copying process and it is the *only* photoprinting process to apply a measured dose of developer, thus ensuring optimum quality.

The majority of AZOFLEX photoprinting machines can, subject to certain conditions, be hired as an alternative to outright purchase, where this is preferred.

AZOFLEX MODEL 42/63. Combined synchronised printer and developer. Capacity: cut sheets and rolls up to 42 in. wide. Printing speed: from 6 in. to 15½ ft. per minute. Dimensions: Height 52 in. Width 67½ in. Depth 52 in. with delivery tray extended. Weight: approximately 850 lbs.

ILFORD *Azoflex*

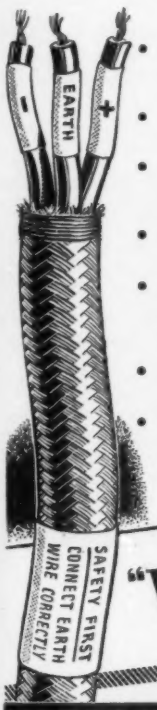
Enquiries to:
Ilford Limited, Azoflex Dept. AZ14F,
104 High Holborn, London, W.C.1
Telephone: HOLborn 3401

MACHINES AND MATERIALS FOR DRAWING OFFICE PHOTOPRINTING

WHICH is WHICH?

You KNOW, but do your customers know?

To follow the "Safety First" recommendation, make sure your electrical leads, whether to Domestic Appliances or to Machine Tools, etc., are clearly defined. "Viskrings" simply slipped over the core-wires and/or the outer casing of the leads do the job and put an end to confusion or doubt.



- NO TOOLS REQUIRED
- NO RUBBER USED
- IMPERVIOUS TO OIL AND PETROL
- INDELIBLY PRINTED
- SUPPLIED IN ALL COLOURS AS WELL AS WHITE
- SELF-FIXING
- DO NOT INCREASE DIAMETER OF LEAD

"VISKRINGS"

for PERMANENT IDENTIFICATION OF ELECTRIC LEADS

VISCOSE DEVELOPMENT CO. LTD.
40 CHANCERY LANE, LONDON, W.C.2
CHANCERY 8111

Industrial plants need

Victor lighting

HOWEVER SPECIALISED your lighting requirements may be, they can be met from the extensive range of VICTOR lighting fittings. The many types available are fully described and illustrated in our catalogues L600 (weatherproof-flameproof) and L700 (non-flameproof), copies of which will be gladly sent on request.

Free

On-the-spot advice of a VICTOR lighting expert is yours for the asking when planning new installations.

If its lighting—its Victor!

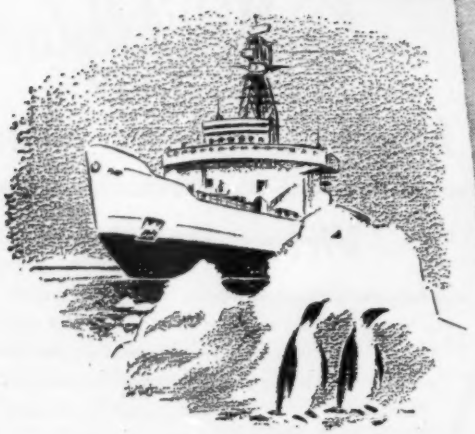
VICTOR PRODUCTS (Wallsend) LTD.
Wallsend-on-Tyne, England
Telephone: 68331 (6 lines) *Telegrams: "Victor" Wallsend*
LONDON OFFICE: 26 Millbank, S.W.1
Telephone: TATe Gallery 0033

IN CONDITIONS LIKE THESE...

N

W E

S



THE LIFE OF ROTATING ELECTRICAL MACHINERY DEPENDS ON THE QUALITY OF THE INSULATING VARNISH

All grades of Sterling electrical insulating varnishes are individually blended to suit the varying conditions under which motors operate in many different parts of the world where so much depends on the varnish. Sterling chemists have to consider—and combat—such diverse factors as extremely high or low temperatures, tropical service, presence of abrasives, alkalis, acids, etc.

Write for details—we shall be pleased to advise you without obligation.

MADE BY CHEMISTS

Sterling

INSULATING VARNISHES

SERVICED BY ENGINEERS

SPECIALISTS IN INSULATION

THE STERLING VARNISH CO. LTD. FRASER RD. TRAFFORD PARK MANCHESTER 17

Telephone: TRAfford Park 0282 (4 lines) *Telegrams: "DIELECTRIC MANCHESTER"*

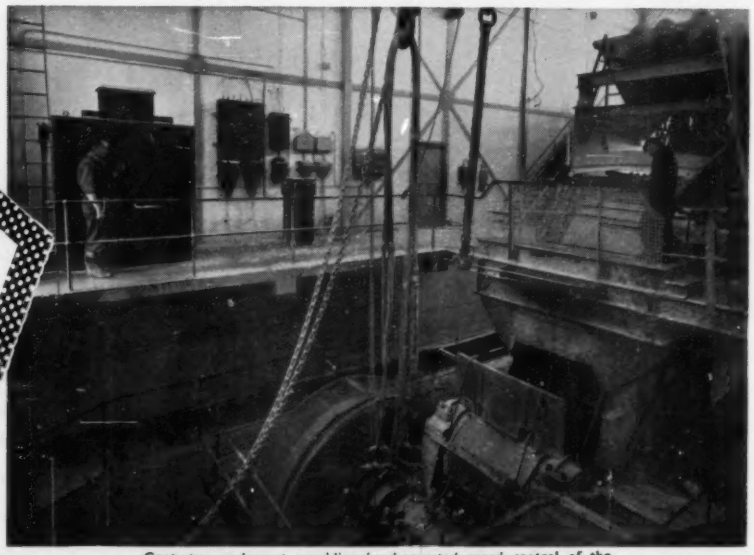
London Office & Warehouse: 6 LONDON ROAD, BRENTFORD, MIDDLESEX. Telephone Ealing 9152

dm STP

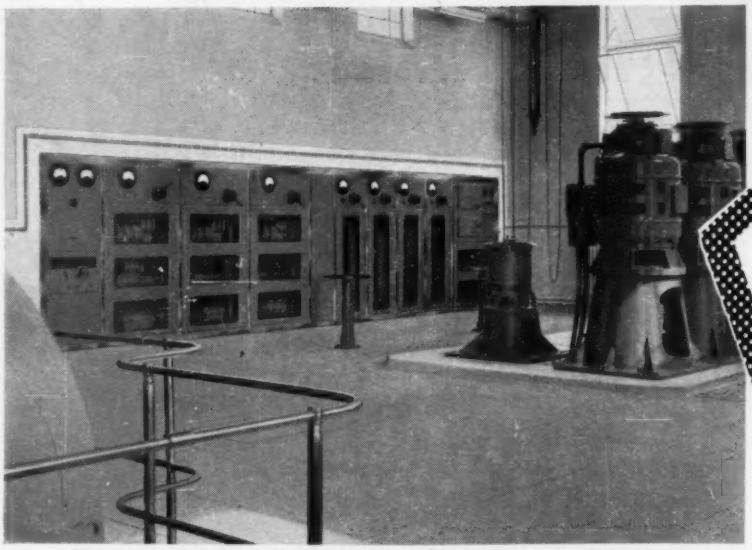
MOTOR CONTROL GEAR

for every industrial application

from the rigours of a Stone Quarry...



Contactor equipment providing hand-operated speed control of the Primary Crusher of Cornelly Quarry of The Steel Company of Wales Ltd



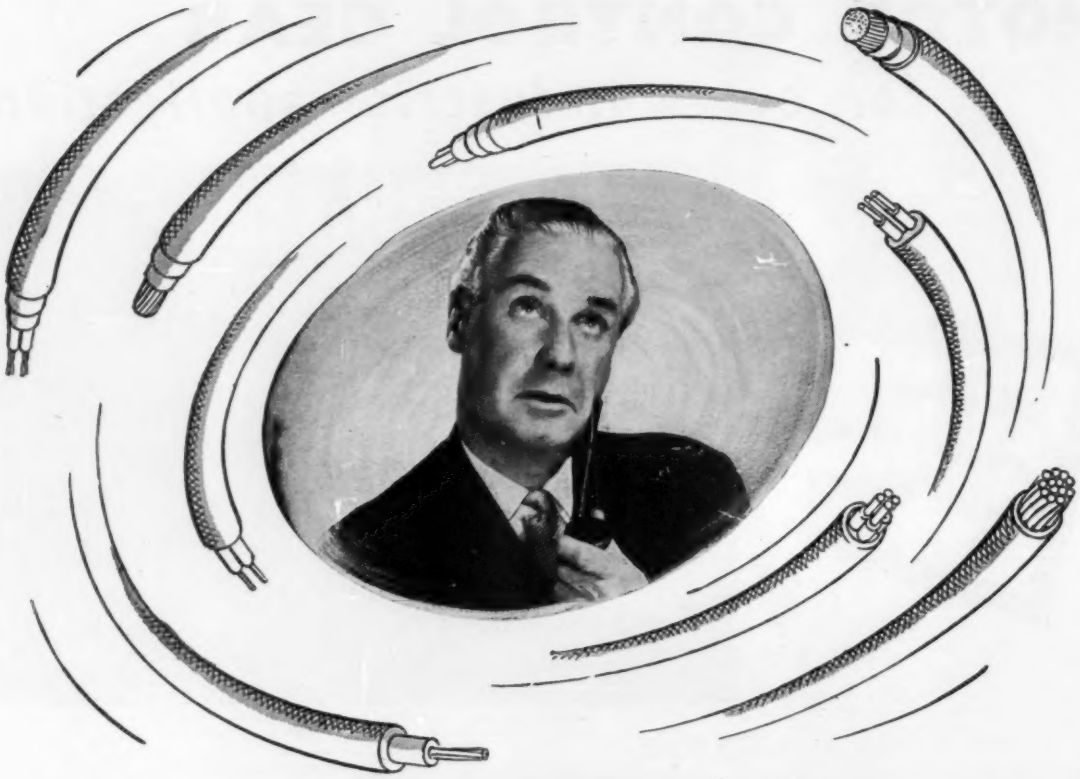
... to the elegance of a Pumping Station

Main control equipment at Hardham Pumping Station of North-West Sussex Joint Water Board

For every electric motor there is an Allen West starter

ALLEN WEST

ALLEN WEST & CO LTD BRIGHTON ENGLAND · Telephone: Brighton 23291 · Telegrams: Control, Brighton
Engineers and Manufacturers of Electric Motor Control Gear and Switchgear
SUBSIDIARY COMPANIES IN CANADA, SOUTH AFRICA AND RHODESIA · AGENCIES THROUGHOUT THE WORLD



Is your head in a whirl about cables?

— what types to get? . . . where to get them? — then the solution is obvious — send for the General catalogue? It gives full details of the wide range of cables made by GCM — VIR, PVC or polythene insulated, rubber or lead sheathed, or asbestos braided and armoured — for all the more ordinary uses and for many special purposes. If, by chance, your project calls for a cable that is not in the normal range, General will gladly make it to fulfil your special requirements.

All cables made by General conform to the relevant requirements of the British Standards Institution.

. . . better send for the catalogue!

GCM

THE GENERAL CABLE MANUFACTURING CO. LTD.

LEATHERHEAD Telephone: Leatherhead 3021 Cables: Isolde, Leatherhead SURREY

LGB

"This is a job for IMHOFS standard raks..."

"We can get quantity delivery in 7 days, too!"

RAKS in 29 different types and sizes —in any quantity—straight off the shelf! That's what Imhofs special service means. By buying standard units you are relieved of all the worry of construction and show a marked saving in production costs. There are Imhofs standard raks and cases to suit every kind of instrument and electrical apparatus—and 'specials' can be supplied at short notice to suit individual requirements. Write now for catalogues and full details.

29 STANDARD RAKS TO CUT YOUR COSTS & SAVE YOU TIME

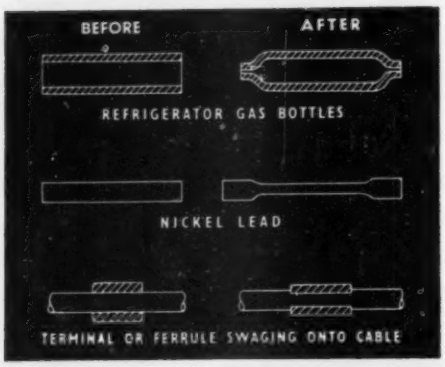
Imhofs standard raks are available in 29 different sizes, with one or more bays as required. Precision-built from fine materials, beautifully designed and finished, they are available for delivery *ex stock* within 7 days. Handles and other accessories can also be supplied at once.

FOR CASES IT'S **IMHOFS**

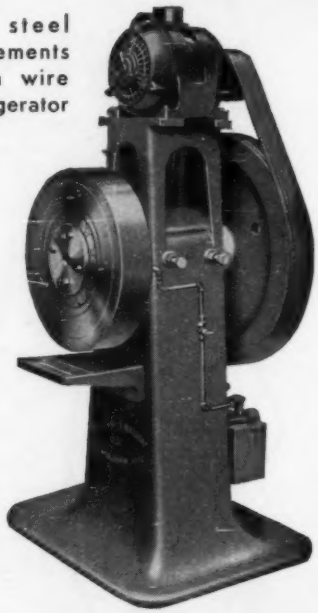
ALFRED IMHOF LIMITED Dept D7 112-116 New Oxford Street, London, WC1 Tel: MUSeum 7878

What is Rotary swaging?

It is a means of reducing or pointing tube and rod by a hammering process



Reducing powder filled steel inconnel and copper elements Tungsten and Molybdenum wire for filaments. Necking refrigerator gas bottles.



TIME, MATERIAL AND MONEY IS SAVED

- No wastage of material
- Operated by unskilled labour
- Cheapest and Quickest method

SEND FOR FULL PARTICULARS—***It might solve your problem***

STEVENS & BULLIVANT LTD.
Western Road · BIRMINGHAM 18

Telephone: NORthern 4514/5 and 0236
Telegrams: "Swager, Birmingham"

DOMESTIC SELF-PRIMING JET-PUMP

THE GODWIN TYPE J.1 JET PUMP has been designed primarily for domestic water supplies, either as pneumatic water system, or for pumping into an open tank.

- Self-Contained air cushion.
- Motor fitted with hand-reset overload protection device.
- No Stuffing box needing periodic attention.
- The same pump for Deep and Shallow Wells.
- There are no moving parts in the well.
- Maximum lift 50 feet.
- Compact—Only 16" diameter x 21" high.

GODWIN Pumps

Write for details from sole manufacturers

H. J. GODWIN LIMITED
QUENINGTON GLOS.

Phone: COLN ST. ALDWYNS 271 (6 lines)
Grams: "PUMPS, QUENINGTON"

FLEXIBLE METALLIC TUBING

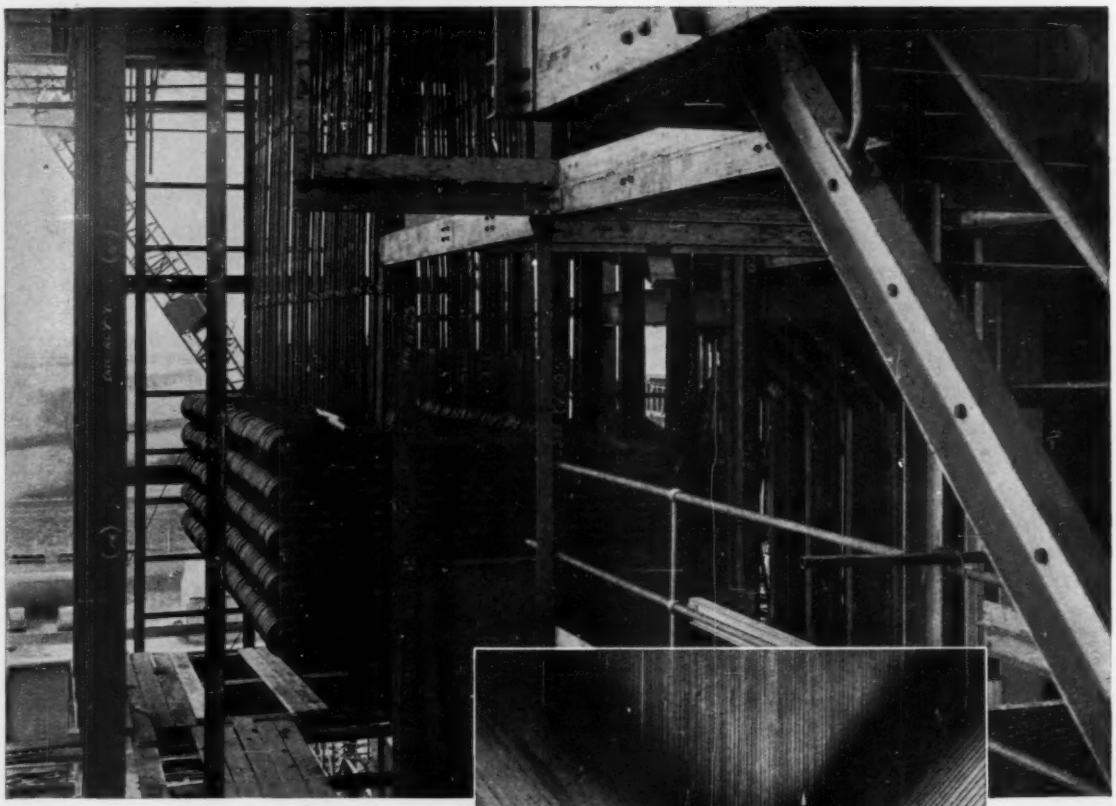
In Steel and Bronze, for all Electrical and Industrial Purposes. Adaptors, Unions, Flanges, Cable Glands and other Fitments for Flexible Tubing

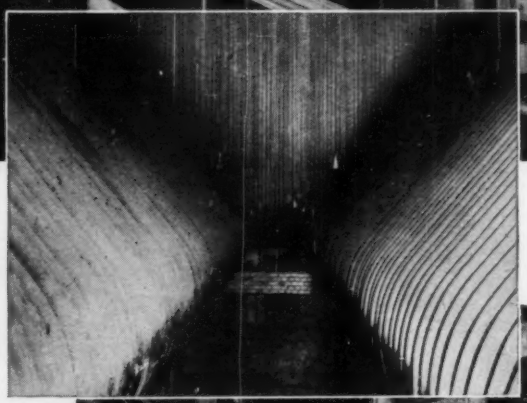
PLANT ENGINEERING CO. LTD.
90-91 COX STREET WEST, BIRMINGHAM 12
Telephone: CALthorpe 1551-2

COIL WINDINGS

S.T.S
CROYDON

SOUTHERN TRADE SERVICES LTD
Southbridge Rd., Croydon Tel. 2727/8

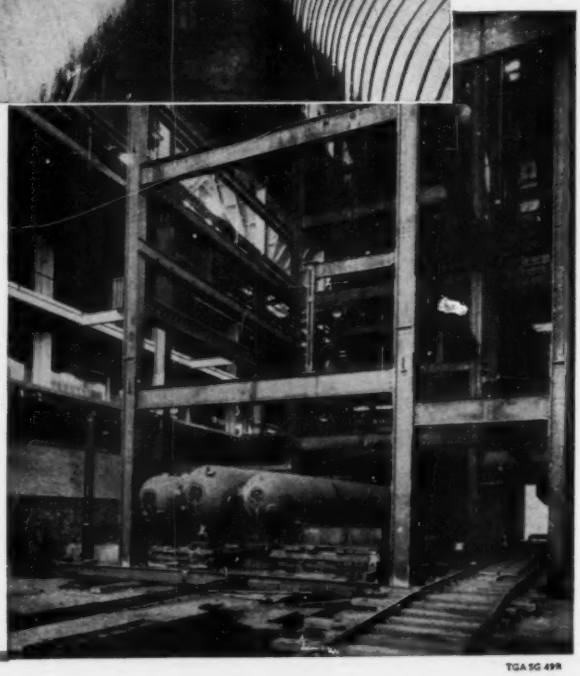




Views of typical boiler installations.

Complete Steam Generation Plant

Maximum efficiency in Industry calls for maximum efficiency of steam generation plant. Vast experience in this sphere of engineering enables IC to design and construct outstanding plant either for the giant power station or the small boiler house.



INTERNATIONAL COMBUSTION LIMITED

London Office: Nineteen Woburn Place, W.C.1. Tel: Terminus 2833

Works: Derby, England

TGA SG 498

B

Stock answer...

By specifying JMC standard headed contacts you can relieve stock problems — for delivery of almost any quantity can normally be made at once. To this, add the advantages of lower cost, sound design and maximum operating efficiency.

The stock answer to many problems of contact selection — and a convincing one — is the adoption of JMC standards.

A series of technical data sheets is free on request.

One of the Specialised Products of

Johnson Matthey

JOHNSON, MATTHEY & CO., LIMITED

73-83 HATTON GARDEN, LONDON, E.C.1. Telephone: Holborn 6989

Vittoria Street, Birmingham, 1. Tel: Central 8004. 75-79 Eyre Street, Sheffield, 1. Tel: 29212

SCI

the power of paper

Famous papers for printing . . . paper for industry and commerce . . . paper for insulating telephone and power cables . . . paper for photography . . . technical papers for plastics and for the electrical industries . . . TULLIS RUSSELL make them all —to the highest standard of quality, consistency and reliability, that has now come to be expected of papers bearing the Tullis Russell emblem.

Tullis Russell & Co. Ltd.

PAPERMAKERS SINCE 1809

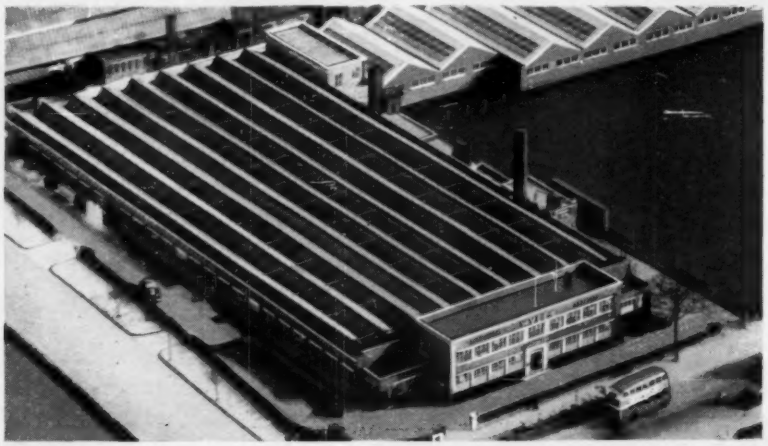
SCOTLAND
AUCHMUTY & ROTHES PAPER MILLS
MARKINCH FIFE

LONDON
IVOREX HOUSE
UPPER THAMES STREET E.C.4

BIRMINGHAM
177 CORPORATION STREET

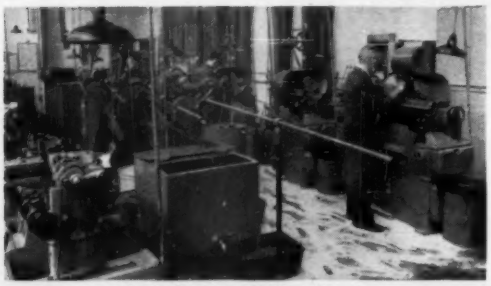
MANCHESTER
372 CORN EXCHANGE BUILDINGS
CORPORATION STREET

Diamond Jubilee of Wylex 1897-1957

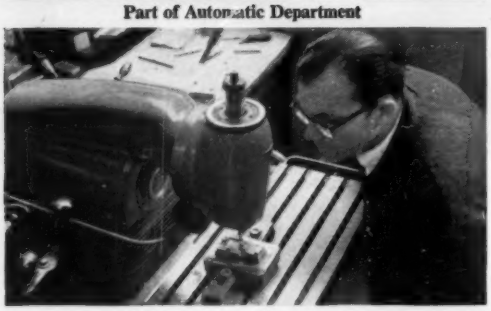


Above **The Wylex Works to-day, at Wythenshawe.**

Left **The original premises at Blantyre Street, Manchester;**



Part of Automatic Department



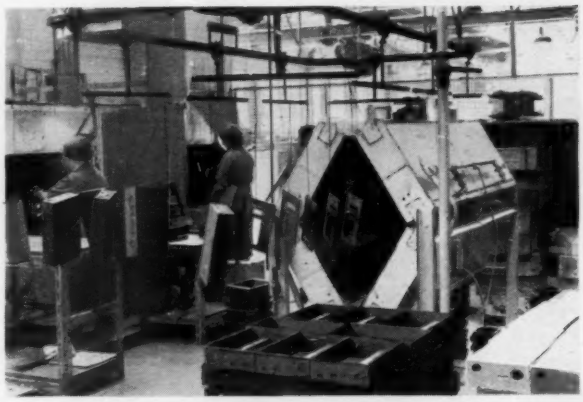
Toolmaking: A highly-skilled team of craftsmen design and make all the dies, tools and fixtures for Wylex products.

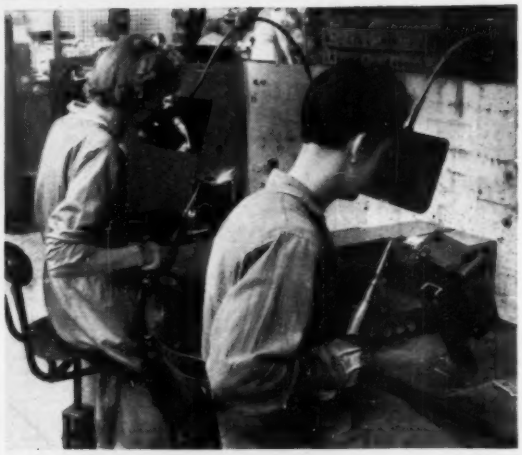
Above
Section of Moulding Department

Left
Ceramic pressing

GEORGE H. SCHOLES & CO. LTD.

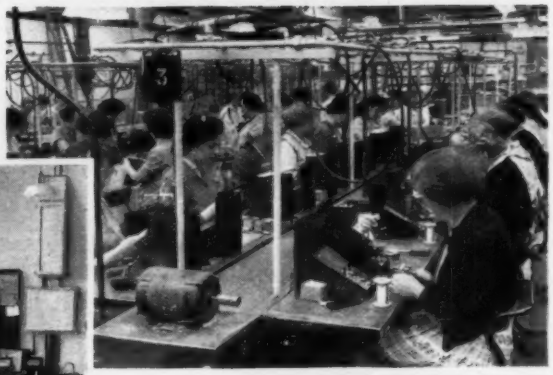
Above & right
Sections of Brass Machining Department





Above & right **Metal Box Manufacture**

Above
Cartridge Fuse Manufacture



Above **One of the Assembly Lines**

Laboratory Tests are carried out on development projects as well as routine production tests.

WYLEX WORKS WYTHENSHAWE MANCHESTER 22

IF YOUR MOTOR NEEDS A CAPACITOR

• for starting • running • P.F. Improvement

• interference suppression or other applications

HUNTS CAN SUPPLY IT!

With every Hunt Capacitor comes the accumulated volume of knowledge and practical skill acquired over more than 20 years of specialisation. Each class of Capacitor is produced under separate laboratory control. Strict examinations of raw materials, careful inspection at intermediate stages of manufacture, and full individual tests on completion, ensure the reliability of the product.

MANUFACTURERS OF CAPACITORS FOR RADIO AND TELEVISION EQUIPMENT, ELECTRONIC EQUIPMENT, POWER FACTOR IMPROVEMENT, CAPACITOR MOTORS, PHASE SPLITTING, H.F. AND R.F. HEATING, IGNITION AND INTERFERENCE SUPPRESSION, TELEPHONE INSTALLATIONS

REGISTERED TRADE HUNTS MARK CAPACITORS

A. H. HUNT (Capacitors) LTD., WANDSWORTH, LONDON, S.W.18 Tel: BATtersea 1083

Factories also in Surrey and North Wales

Place your order now for single and three phase moving coil voltage regulators in the following ratings and types :

Throughput kVA	Phase	Type
50 kVA	3	Pole Mounting
100 kVA	3	Feeder Pillar
200 kVA	3	Feeder Pillar
333 kVA	3	Feeder Pillar
10 kVA	1	Pole Mounting
25 kVA	1	Pole Mounting

These voltage regulators will cater for a voltage variation of — 11% on any nominal supply voltage between 346 volts and 433 volts, 50 cycles, 3 phase (200 volts and 240 volts, single phase), and will maintain the output voltage constant within ± 1% of nominal.

FERRANTI LTD · HOLLINWOOD · LANCASHIRE
London Office: KERN HOUSE · 36 KINGSWAY · W.C.2

FT 195/2

NEW QUALITY STANDARDS

Coincident with the issue of an Amendment to B.S.7, which covers Vulcanised Rubber Insulated Cables and Flexible Cords for Electric Power and Lighting, an entirely new British Standard (B.S.2899) has been introduced to govern the quality of all the insulating and sheathing compounds used in the manufacture of this range of Electric Cables and Flexible Cords.

These Specifications came into force on 1st January, 1958, and Scottish Cables Limited have pleasure in announcing that, as and from that date, a complete range of standard cables, manufactured under ideal conditions and guaranteed to comply with the new Quality Standards, is available at Economic Prices.

Specify 'SCOTTISH'—for guaranteed quality at economic prices!

SCOTTISH CABLES LIMITED

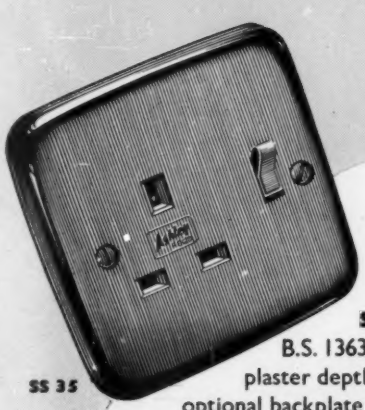
DEANSIDE • RENFREW • SCOTLAND

LONDON OFFICE • BUSH HOUSE • ALDWYCH, W.C.2

Associated Company: SCOTTISH CABLES (SOUTH AFRICA) LTD. PIETERMARITZBURG, NATAL

Ashley REGD 13 AMP. RING CIRCUIT ACCESSORIES

Visit us at Earls Court March 25-29th

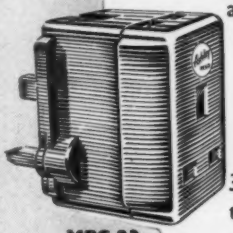


SS 35

J 401

SOCKETS & SWITCHSOCKETS. B.S. 1363 & 2814. Brown or Cream. Flush, for plaster depth or deep socketboxes. Surface, with optional backplate I.E.E. 207G. Safety shuttered. Quiet switch, silver contacts, nylon pad.

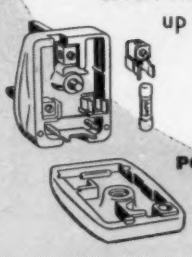
FUSED PLUG. B.S. 1363. Brown or Cream. Block terminals. B.S. 1362 Cartridge Fuse-Link, 13 Amp. supplied, 10, 5 or 2 Amp. also available. Optional, High Impact resistant type, Black.



MPG 23

SOCKET ADAPTOR. Complies I.E.E. 611(a). Brown or Cream. Safety shuttered twin outlets. B.S. 1362 13 Amp. Cartridge Fuse-Link.

SELECTIVE ENTRY SPUR BOX (Pat.). B.S. 816 3½" dia. x 1¼" x 2" fixing centres. Four cable entries, those unused closed by shutters integral with cover. Three block terminals each taking up to four 7/.029 conductors.



PG 13

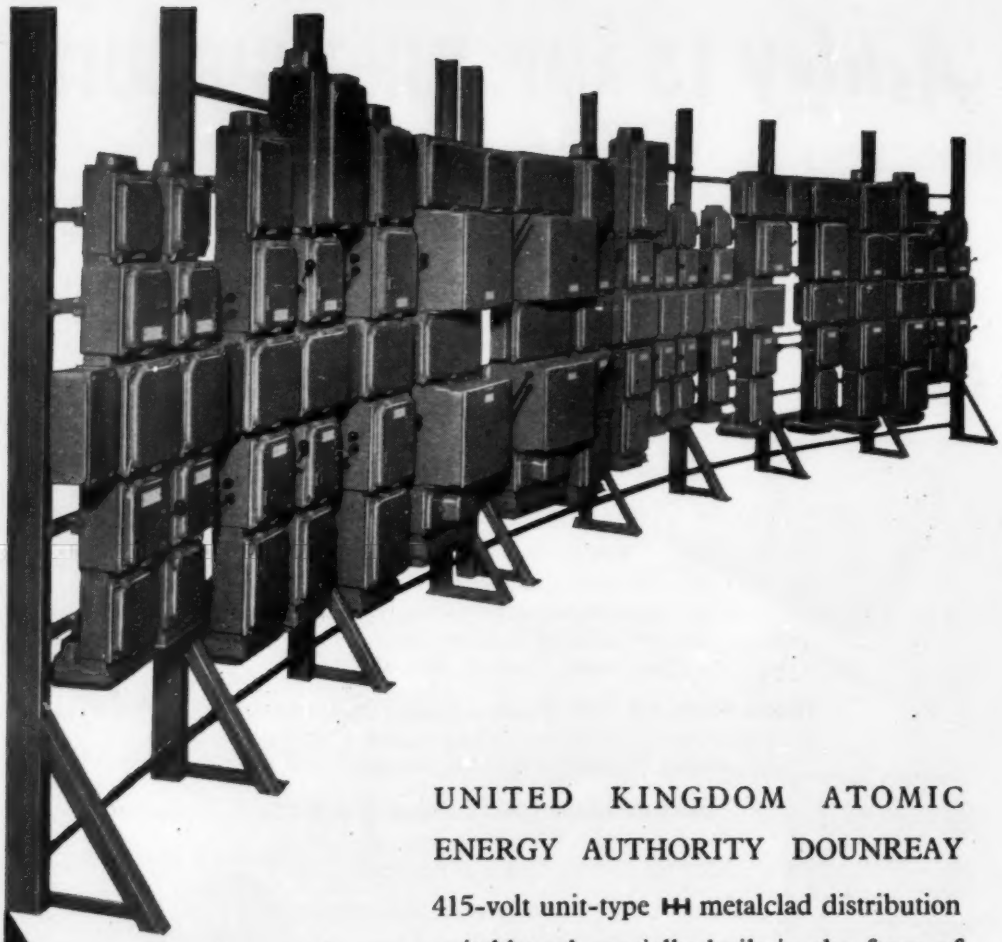
SK 31

Literature and technical service, with pleasure.

Ashley REGD.

ASHLEY ACCESSORIES LIMITED, ULVERSTON, LANCASHIRE
Telephone: Ulverston 3333 *Telegrams:* Ashley, Ulverston
MEMBER OF THE ASHLEY GROUP

AY 102



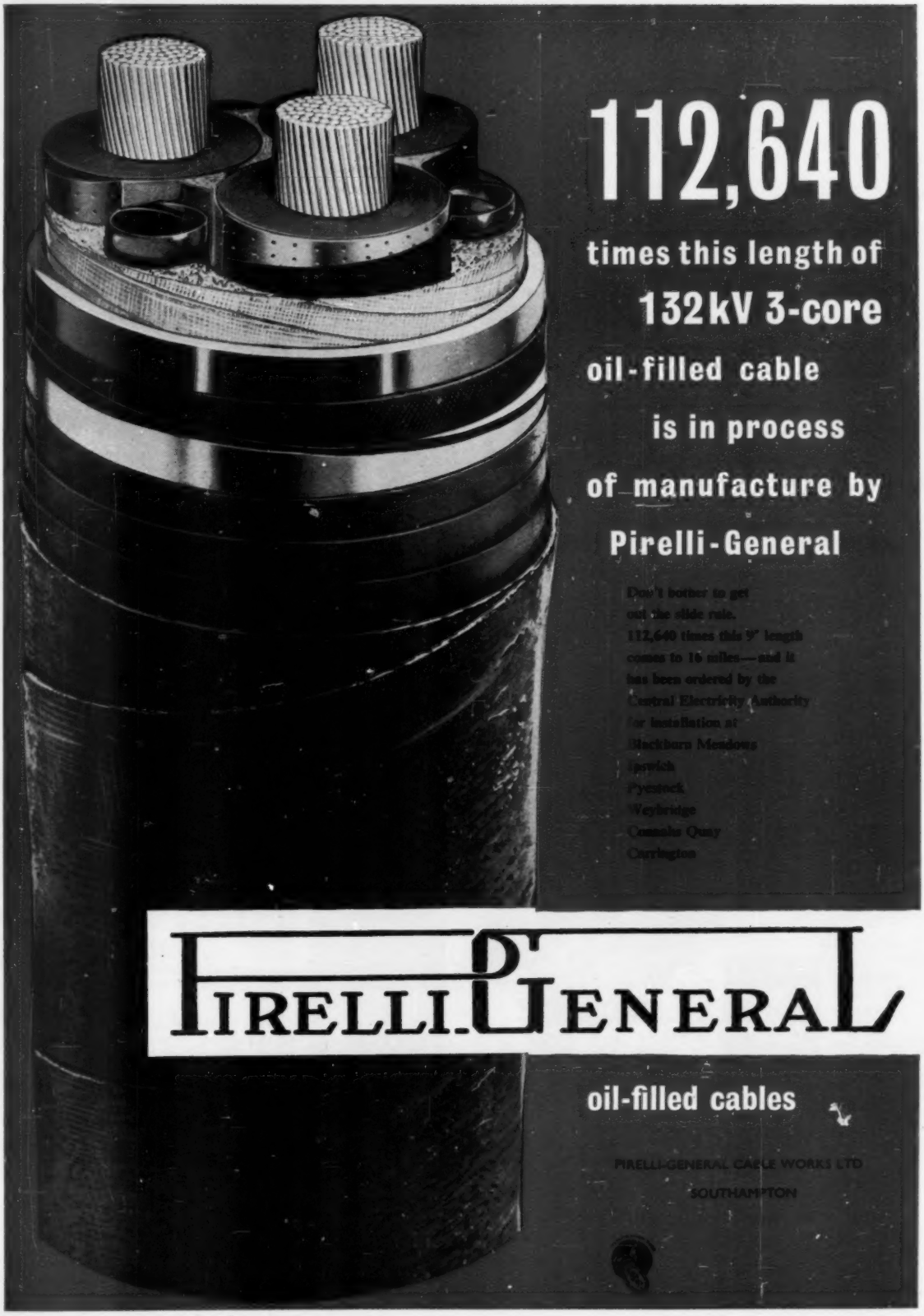
UNITED KINGDOM ATOMIC ENERGY AUTHORITY DOUNREAY

415-volt unit-type HH metalclad distribution switchboard specially built in the form of an arc to follow the circumference of a room 70 feet in diameter

Reyrolle

HEBBURN · COUNTY DURHAM · ENGLAND

MEMBER OF THE NUCLEAR POWER PLANT CO. LTD. NPPC



112,640

times this length of

132kV 3-core

oil-filled cable

is in process

of manufacture by

Pirelli-General

Don't bother to get out the slide rule. 112,640 times this 9" length comes to 16 miles—and it has been ordered by the Central Electricity Authority for installation at Blackburn Meadows Ipswich Pyewack Weybridge Connahs Quay Carrington

PIRELLI-GENERAL

oil-filled cables

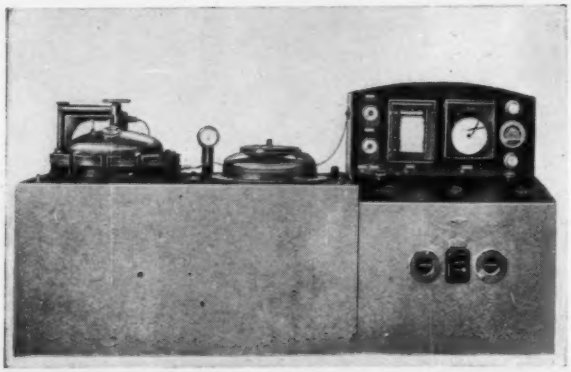
PIRELLI-GENERAL CABLE WORKS LTD

SOUTHAMPTON

BLICKVAC
HIGH PRESSURE & VACUUM IMPREGNATORS

BLICKVAC Impregnators are used by Marconi, Pye, S. Smith & Sons, N.C.B., M.O.S. and many other well-known organisations. A full range of standard models is available — capacities 4 in. by 9 in. to 3 ft. by 3 ft. — suitable for Varnish, Wax, Potting Resins, etc. Plants can be designed for special requirements. Blickvac Impregnators are designed to give simplicity in control, outstanding performance and ease in cleaning. A second autoclave can be added at low cost when needed.

BLICKVAC products include :- Epoxy Resin Vacuum Mixing and Casting Plants, Electric Ovens, Vacuum Ovens, Mixing Vessels, Dipping Tanks, etc.

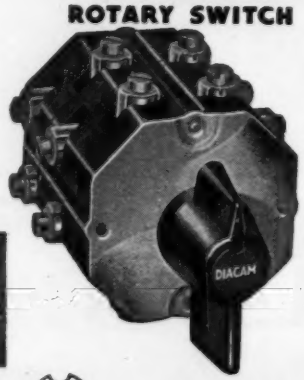


BLICKVAC ENGINEERING LTD. Bede Trading Estate, Jarrow, Co. Durham
Telephone: Jarrow 897155

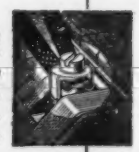
LONDON OFFICE: 96/100 Aldersgate St., E.C.1
Telephone: MONarch 6256

THE VERSATILE DIACAM ROTARY SWITCH

This 30-amp. rotary switch has solid silver contacts and a double-break on each pole, ensuring maximum efficiency and absolute safety under all conditions. Available in most sequences for either single or multi-pole switching.



This shows the patent terminal clamp securing two conductors

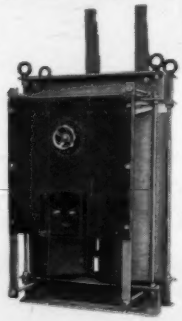


The specially engraved identity discs, also panel mounting indicator plates, can be supplied to customers' requirements

CRAIG & DERRICOTT LTD.
ROYAL WORKS, SUTTON COLDFIELD. Tel.: Sutton Coldfield 2547

Andec LIMITED

TRANSFORMERS LARGE OR SMALL



The illustration is of a 60 KVA Transformer with a 5,000 amp. Secondary, with tapped Primary to give secondary voltage variation from 12 volts to 4 volts. Primary tap changes are made with a rotary switch as shown. These Units are designed and tested to BSS 171 where applicable, or appropriate B.S. Specification.

This is a typical example of our "C" Core range. We manufacture both open and hermetically sealed types, wound to customers' specifications. This range extends from 10 VA to 1.6 KVA at frequencies up to 2,000 cps.

WHATEVER YOUR NEEDS — OUR TECHNICAL AND DESIGN DEPARTMENTS ARE AT YOUR SERVICE

ANDEC LIMITED
A.I.D., A.R.B. approved
BENNET ROAD • READING • BERKSHIRE
Tel. 82401/2

H.R.C. FUSE-LINKS

Compliance with British Standard

B.S.88:1952 requires tests to be taken to prove compliance with the following:—

Clause 15:	Insulation Resistance.
Clause 16:	Temperature Rise at current rating.
Clause 17:	Time Current Characteristics.
Clause 18:	Minimum Fusing Current.
Clauses 19–22:	Short Circuit Performance.

All 'ENGLISH ELECTRIC' H.R.C. Fuse-Links to B.S.88:1952 listed in our Price List FG/127B have been fully tested to Clauses 15–22 inclusive proving compliance in all respects with B.S.88:1952 and Certificates of Short Circuit Rating have been issued by the Association of Short Circuit Testing Authorities.

IMPORTANT

When any change, however small, is made in design, materials, or methods of construction of an 'ENGLISH ELECTRIC' H.R.C. Fuse-Link likely to affect its performance, it is re-tested to Clauses 15–22 inclusive and proved to comply with B.S.88:1952 in all respects before being manufactured for sale.

Install

'ENGLISH ELECTRIC'

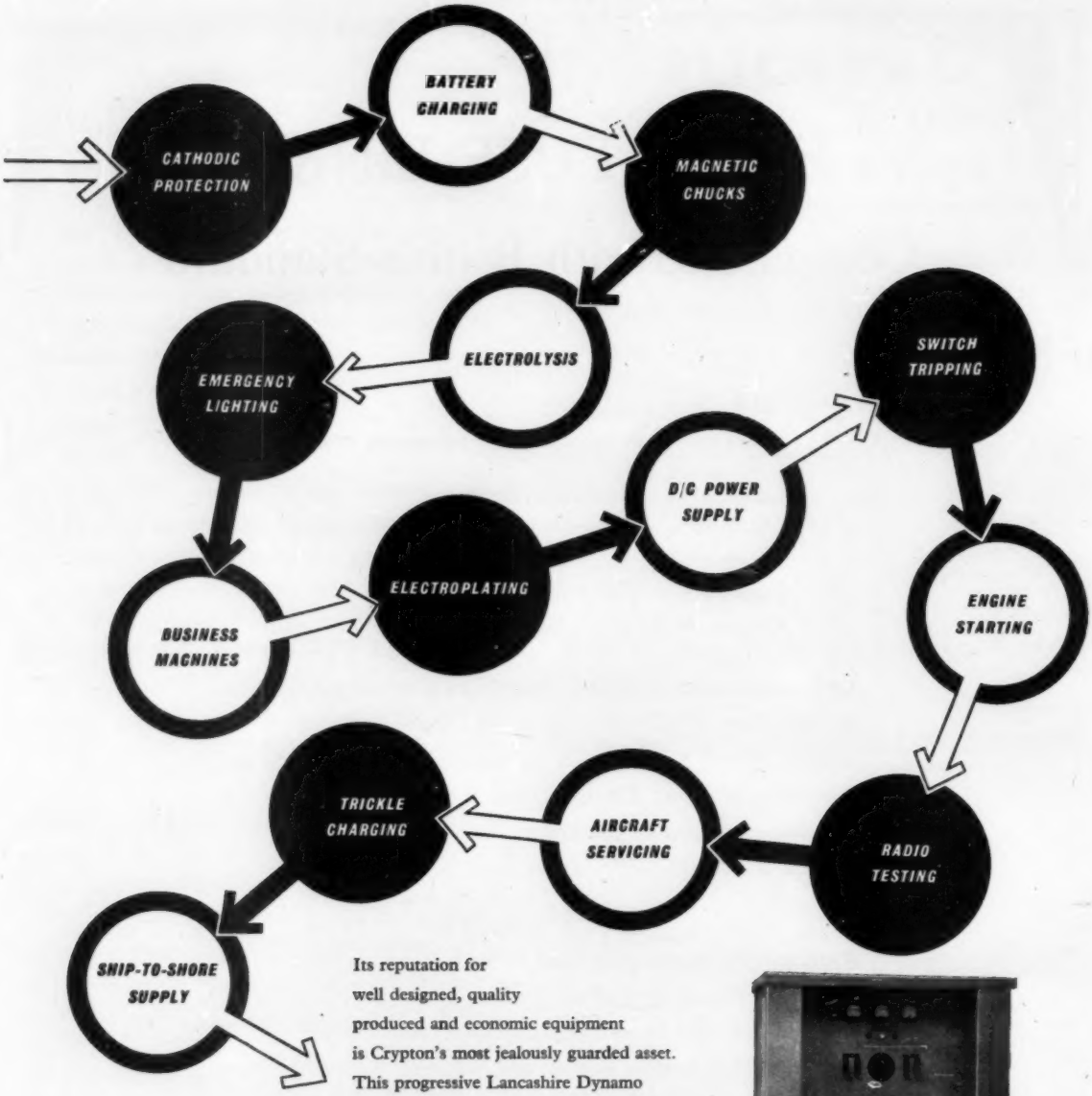
and be safe

THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2

Fusegear Division, East Lancashire Road, Liverpool, 10

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

FGB9L7



DEPENDABLE D.C. from A.C. mains

Its reputation for well designed, quality produced and economic equipment is Crypton's most jealously guarded asset. This progressive Lancashire Dynamo company is producing really dependable products for companies throughout the world to whom reliability in the supply of D.C. from A.C. mains is the prime consideration. An enquiry to Crypton at Bridgwater will receive prompt attention.

CRYPTON

industrial rectifiers

CRYPTON EQUIPMENT LIMITED BRIDGWATER SOMERSET ENGLAND

A Member of the Lancashire Dynamo Group

Telephone: Bridgwater 2614 Telegrams: Cryptoquip Bridgwater
London Address: St Stephens House Victoria Embankment London SW1

P604

CARTRIDGE FUSE-LINKS

Domestic Type Complying with B.S.1361: 1947 5, 15 and 30 amp. Category of Duty 250 AC3 A.S.T.A. Certified

Service Type up to 60 amp. Complying with B.S.88: 1952 A.S.T.A. Certified

Service 250
Category of duty 250 AC4

Service 440
Category of duty 440 AC4

Send for Folder 30/A

SLOW-BREAK SWITCHES

Of robust design with non-track mouldings and suitable for up to 500 volts A.C. only.

30 ampere, double-pole, back or front entry
60 ampere, double-pole, front entry
60 ampere, triple-pole, front entry
60 ampere, triple-pole, back entry

Send for Folder 45/N

HENLEY

ELECTRICAL DISTRIBUTION EQUIPMENT

Watch this series of advertisements for many of the interesting items in our wide range of products. We shall be pleased to send you full information.

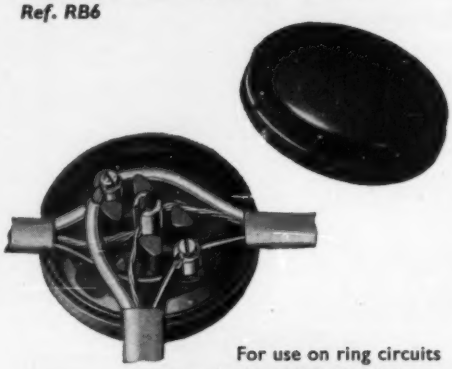
COLD FILLING COMPOUND

For filling cable boxes for paper or rubber insulated cables for working pressures up to 11kV. Consists of black compound and hardening agent (supplied in separate tins) No heating—invaluable for use in collieries, oil refineries, petrol stations, etc.,

Send for Folder 57/D

INSULATED JOINT BOX

Ref. RB6



For use on ring circuits
As required by I.E.E. Regulations, 13th Edition, 1955, Clause 114(B) (ii)
For conductors up to 7/·036"

Send for Leaflet WSA/3

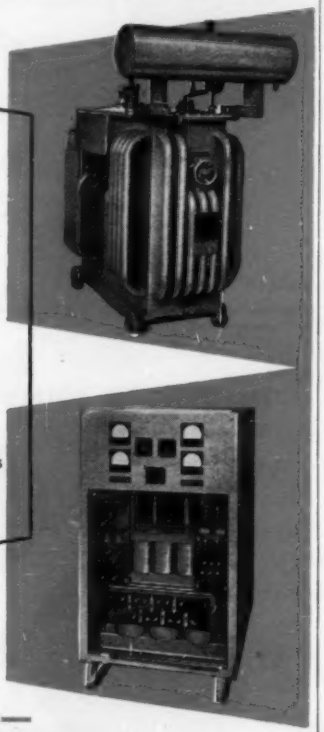
W. T. HENLEY'S TELEGRAPH WORKS CO. LTD., 51-53 HATTON GARDEN, LONDON, E.C.1 *Tel: CHAncery 6822*

HIGH STREET
GUILDFORD

Transformers and Rectifiers of merit — made at Guildford

TRANSFORMERS
- ★ Distribution
- ★ Electronic Equipment
- ★ Rectifiers
- ★ H.F. Heating
- ★ Low Voltage Supplies
- ★ Welding
- ★ Furnaces, etc.

RECTIFIERS
- ★ Battery Charging
- ★ D.C. Motors
- ★ General Power Supplies
- ★ Engine Starting
- ★ Welding, etc.

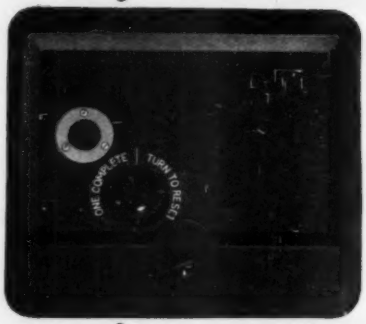


You can depend on—

TRANSFORMERS & RECTIFIERS LTD.

Dept. E.I.
MILLMEAD · GUILDFORD · SURREY
Tele: Guildford 66764 *Grams: Transrect, Guildford*

EARTH LEAKAGE RELAY



Containing a large robust moving coil movement. Magnet assisted positive action make or break contact at 100 milliamps – 600 volts. Hand release.

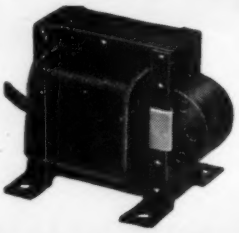
THE ELECTRICAL INSTRUMENT CO. (HILLINGTON) LTD.
47 Boswell Square, Hillington, Glasgow, S.W.2
Telephone: Halfway 1166 *Telegrams: ELINCO*

ENGRAVING & ETCHING EQUIPMENT

Will etch on any metal including hardened steel. Ideal for all difficult marking jobs. Invaluable to all engineers. Send for interesting booklet —25.X.

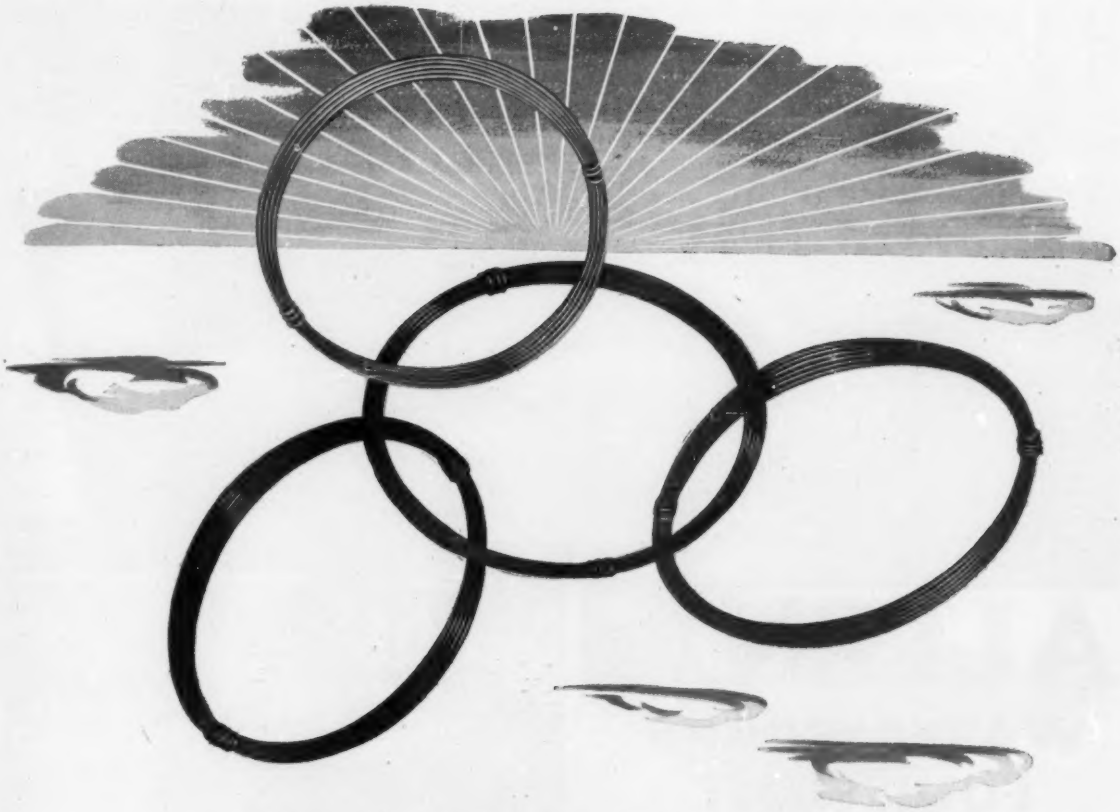
Runbaken
MANCHESTER 1 · ENGLAND

A. C. SOLENOID TYPE SAM



Increased Performance
Continuous 14 ozs. at ¾"
Instantaneous to 5½ lbs.
Same dimensions as type SA
Larger and Smaller Sizes Available. Greatly increased discounts for quantities. Also Transformers to 7 kVA 3-phase

R. A. WEBBER LTD.
18 FOREST ROAD, KINGSWOOD, BRISTOL Phone 67-4065



Wire in modern perspective

This Company manufactures an extensive range of insulated wires designed to meet all electrical needs and all types of application.
Additionally a first class technical service based upon considerable experience and progressive research is offered to all manufacturers of electrical apparatus.

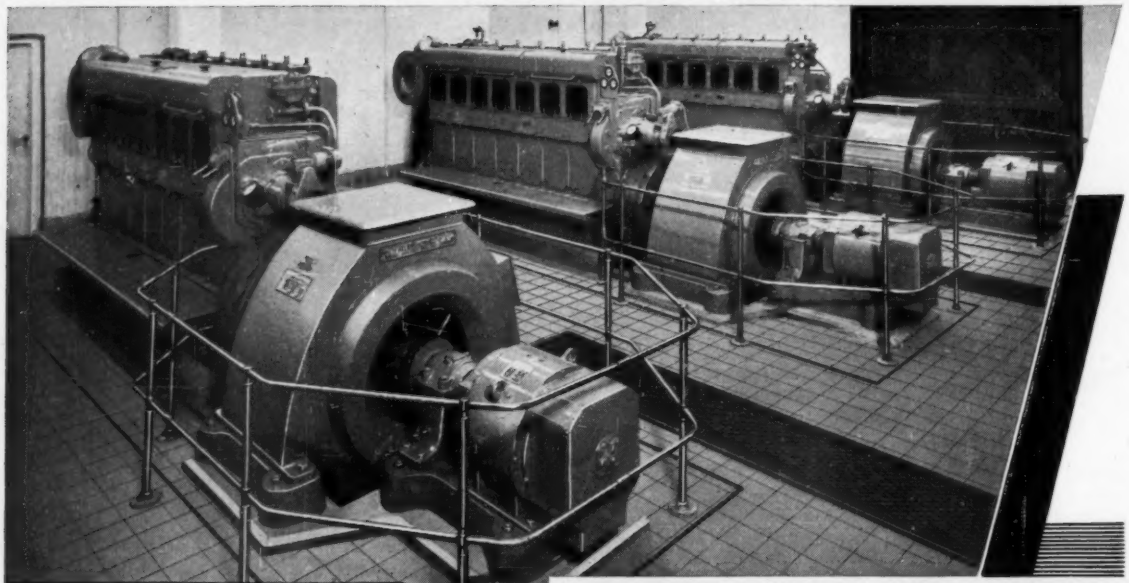
LEWCOS

the largest manufacturers of insulated wires and strips in Europe

THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LIMITED

LEYTON · LONDON · E10

C



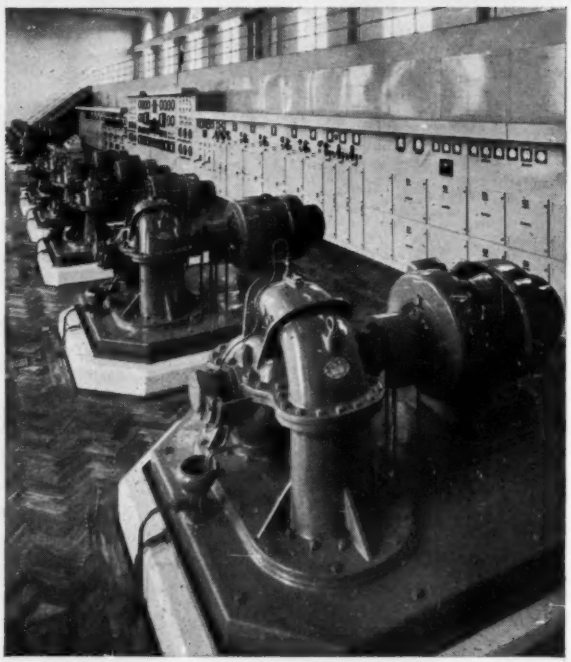
ALLEN

WATERWORKS EQUIPMENT

A complete installation of DIESEL GENERATING PLANT and ELECTRICALLY-driven PUMPS at the Pitsford Works of the Mid-Northamptonshire Water Board

The generating plant (above) comprises three 7-cylinder, 435-b.h.p., 600-r.p.m. Allen four-stroke, pressure-charged diesel engines driving 300-kW Allen alternators: the pumping plant (right) includes ten Allen single-stage, double-suction pumps of varying sizes and capacities, driven by Allen screen-protected, slip-ring motors — four 81-h.p., three 112-h.p. and three 140-h.p.

The total capacity of the ten pumping units is **45,000,000** gallons of water per day.



64 Allen pumping units have been installed for service in connection with the Pitsford waterworks scheme.

Engineer and Manager
L. H. Brown, Esq., B.Sc., M.I.C.E., M.I.W.E.

Specialists in complete Waterworks Pumping Plant installations

W. H. ALLEN SONS & Co LTD

BEDFORD ENGLAND

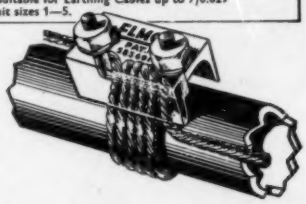
"ELMO"

EARTHING CLAMPS

A COMPLETE RANGE TO B.S.951. 1948 IN 4 SIZES

	A123	B45	C67	D8910
for earthing cables up to	7/0.036"	7/0.064"	19/0.064"	19/0.083"
to fit B.S. conduit sizes i.e. in trade terms	1, 2 & 3 ½" to ¾"	4 & 5 1" and 1¼"	6 & 7 1½" and 2"	8, 9 & 10 2½" to 3½"

NOTE ALSO: Type A123 is suitable for Earthing Cables up to 7/0.029" and for B.S. conduit sizes 1—5.



"Elmo" Earthing Clamps are of robust construction. Impossible for wire to pull out, always under tension, therefore a most satisfactory earth and a permanent safeguard.

ELECTRICAL FITTINGS

Flexible-to-rigid
CONDUIT COUPLINGS

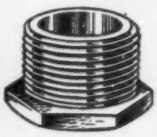
Made in zinc base alloy in the following sizes

Electric Thread (Male) ⅜" ½" ¾" 1" 1¼" 1½" 2"
Inside Diameter ⅜" ½" ¾" 1" 1¼" 1½" 2"

Electric Thread (Male) ⅜" ½" ¾" 1" 1¼"
Inside Diameter Flexible Conduit ½" ⅝" ¾" 1" 1¼"

WITH EARTHING TERMINAL

Special Features: Integral Earthing Terminal, tinned ready for soldering. Fixing screw for continuity. Internal threads suit all makes of flexible tubing.



MALE
Hex. Section

CONDUIT BUSHES

Made in the following sizes:

MALE: Electric Thread
⅜" ½" ¾" 1" 1¼" 1½" 2"

FEMALE: Electric Thread
⅜" ½" ¾" 1" 1¼" 1½" 2"

FEMALE
Flat Face Section for Spanner (except ⅜" size, which is round)

CONDUIT HOOK

For fluorescent lamps and overhead lighting fittings. Screwed ⅜" thread, male electric.

Made to fit all standard boxes with two holes 7/32" diameter — 2" centres diametrically opposed. Designed in accordance with British Standard Specification.

Both made in aluminium alloy

CEILING PLATE

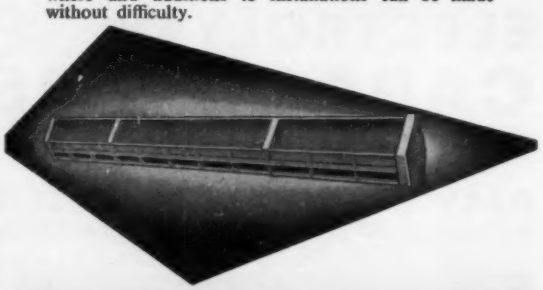
One hook

Manufactured by M. MOLE & SON LTD.
BIRMINGHAM · 3 · ENGLAND Est. 1835

SMITHLITE

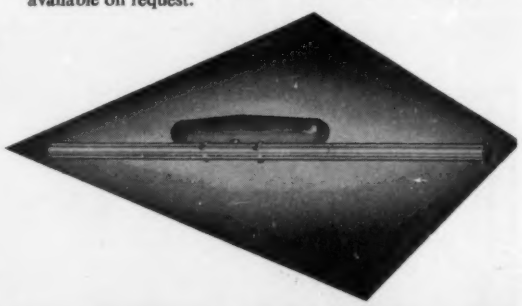
CABLE TRUNKING

Fabricated from rustproof steel stove enamelled or galvanised steel, self colour, in 16, 18 and 20 S.W.G. according to size. Available in 6 feet and 10 feet lengths for early delivery.
This trunking can be dismantled and used again elsewhere and additions to installations can be made without difficulty.



FLUORESCENT FITTINGS

Suitable for offices, showrooms, etc. Manufactured in a wide range to almost every need. All fittings are rust proof and stove enamelled. Totally enclosed control gear is fitted as standard.
Catalogues giving full details of the complete range are available on request.



CONTEMPORARY BATTENS

(Incorporating the SMITHLITE centre contact lamp) suitable for all lamps 5 feet to 2 feet. Available in Red, Blue, Green, Yellow, Cream or White. The control gear is totally enclosed and the design reduces metal work to a minimum.
Fully illustrated leaflets and prices obtainable on request.

HERMAN SMITH SMITHLITE LTD

EMPIRE WORKS · DUDLEY · WORCS.

TELEPHONE: DUDLEY 3178 2 LINES
TELEGRAMS: SMITHLITE DUDLEY

TAKE YOUR PICK

Our wide range of capacitors, incorporating all the very latest developments, are described fully in these new leaflets . . .

SEND NOW for COPIES

DALY has succeeded in maintaining full capacity values and working voltages in more compact designs, specially suited to ultra-modern equipment:

PHOTO-FLASH EQUIPMENT • DEAF AIDS
PRIVATE TELEPHONE INSTALLATIONS
AMPLIFIERS • D.C. POWER UNITS
TRANSISTOR EQUIPMENT
MAGNETISATION EQUIPMENT
TEST GEAR

DALY
ELECTROLYTIC CAPACITORS

Condenser Specialists for over 20 years.

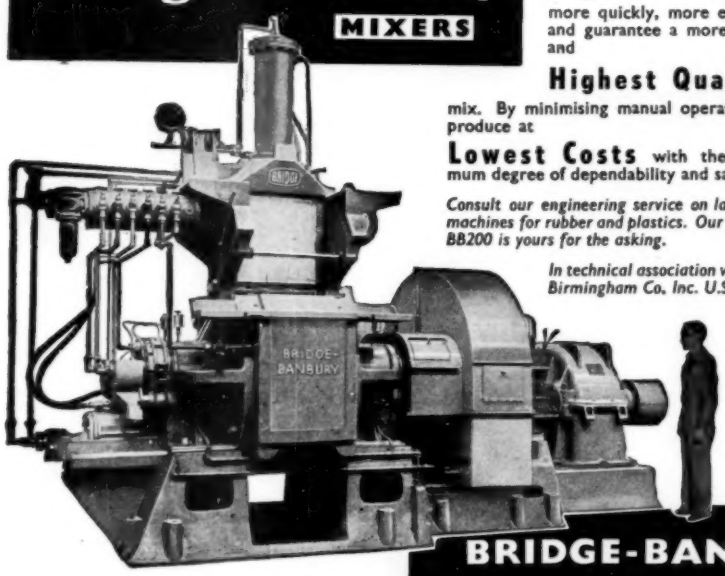
DALY *(Condensers)* **LTD.,** WEST LODGE WORKS,
THE GREEN, EALING, LONDON, W.5. PHONE: EALING 3127-8-9. CABLES: DALCYON, LONDON

Bridge-Banbury MIXERS

Produce the **Highest Output** more quickly, more efficiently, and guarantee a more uniform and **Highest Quality** mix. By minimising manual operating they produce at **Lowest Costs** with the maximum degree of dependability and safety.

Consult our engineering service on layouts and machines for rubber and plastics. Our catalogue BB200 is yours for the asking.

In technical association with Farrel-Birmingham Co. Inc. U.S.A.



SIZE 11 BRIDGE-BANBURY

BRIDGE-BANBURY *Automation*

DAVID BRIDGE & CO. LTD., CASTLETON, ROCHDALE, LANCS
Phone: CASTLETON (ROCHDALE) 57216 Grams: Coupling Phone Castleton Lancs
LONDON OFFICE: BROUGHTON HOUSE, 6-7-8 SACKVILLE STREET, PICCADILLY, W.1
Phone: REGENT 7480 Grams and Cables: "EDERACEO" Piccy London

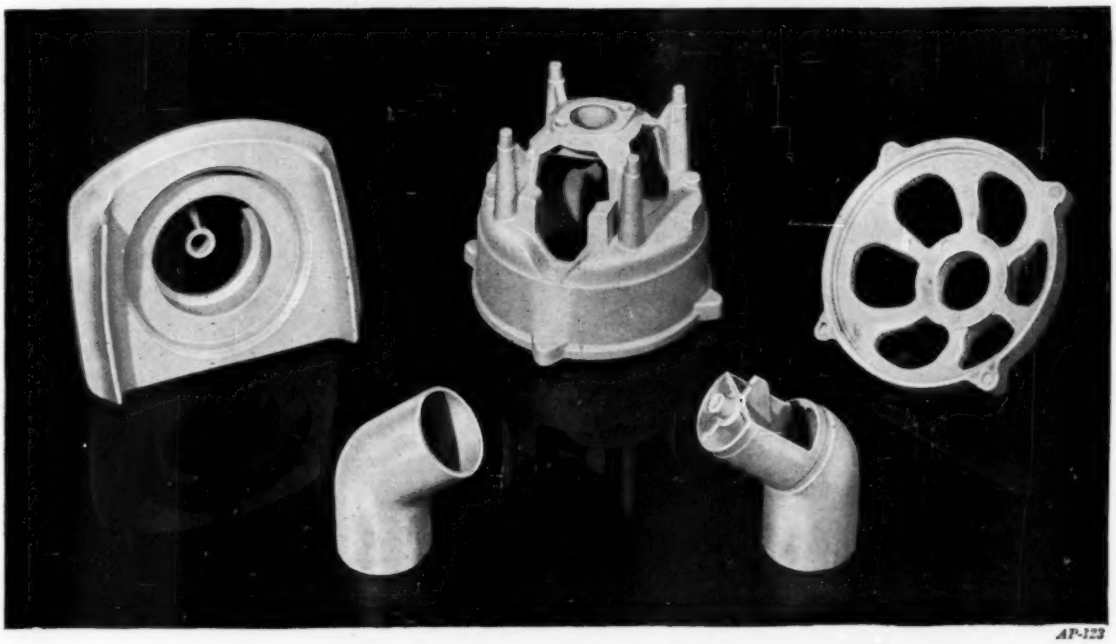
Electrolux cylinder type Suction Cleaner model 62 and accessories.

Aluminium Alloy Castings

by William Mills Limited

FRIAR PARK FOUNDRY · FRIAR PARK ROAD · WEDNESBURY · STAFFS.

Photographs by courtesy of Electrolux Ltd., London, W.1.



AP-122

Introducing 2 new versatile and compact units for surface hardening and brazing heavy sections

G.E.C.

18 kW and 7 kW

High Frequency

Induction Heaters

Each heater has a power output control to adjust impedance matching of the loads giving optimum conditions for a wide range of applications.

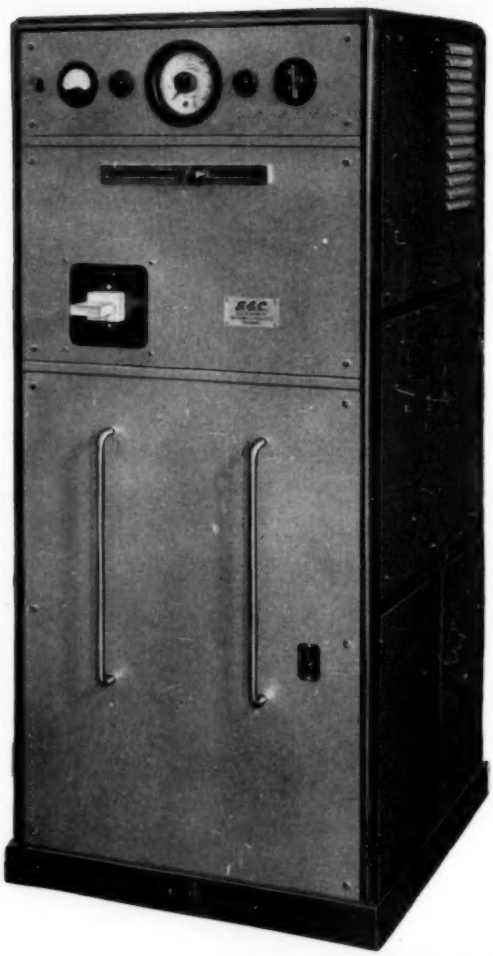
The work coils are easy to make and easy to interchange.

Tank circuit has a high kVA rating, allowing the full available power to be applied to very difficult loads.

Work table supports are fitted on the lower front panel and retracting trunnions are provided at the base to facilitate movement.

Finished in stove-enamelled Oxford blue with front panel stove-enamelled polychromatic silver. Output control guide plate and work table supports chromium plated.

Write for further information.

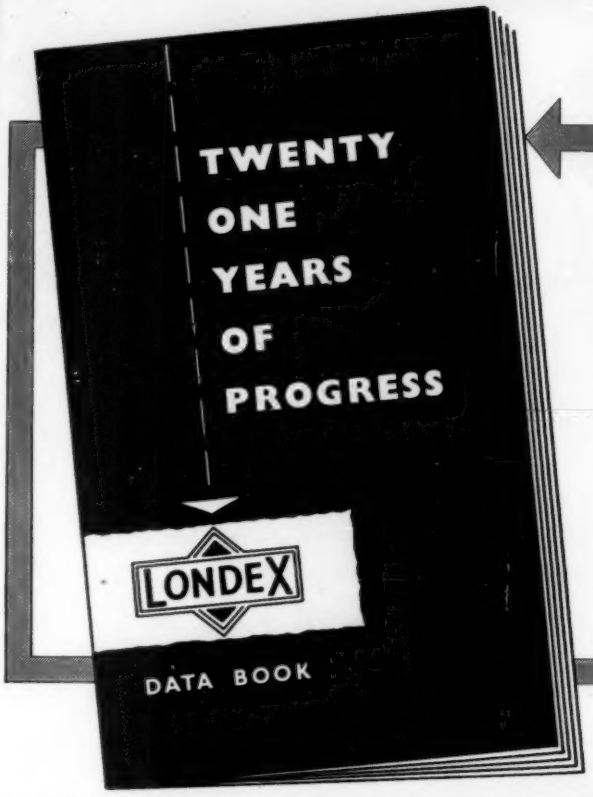


THE 18 kW HIGH FREQUENCY INDUCTION HEATER

For efficient process heating use

G.E.C. FURNACES • HIGH FREQUENCY • INFRA-RED

THE GENERAL ELECTRIC COMPANY LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.

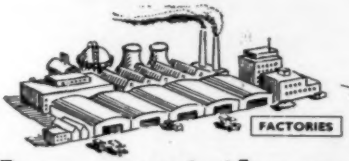


THE latest edition of our Data Book entitled "Twenty one years of progress" which now contains 40 pages has just been published. It contains illustrations and specifications of our full range of products comprising **Relays, Process Timers, Pressure and Vacuum Switches, Liquid Level Controls, Flow Indicators, Photo-Electrical Control Equipment, etc.**

If YOU buy Automatic Electrical Control Apparatus, a FREE copy will gladly be sent on request.

LONDEX LTD.

ANERLEY WORKS, LONDON, S.E.20
Telephone : Sydenham 3111


FACTORIES

AEROPLANES

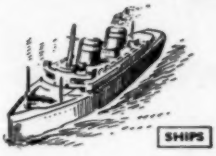
HOUSES

You meet them everywhere...

POWER STATIONS

. . . on machinery and instruments the world over — engraved plates by Thew of Gateshead instructing, warning, or directing in many languages. You will find them too, on ships of every nation, on planes, and on trains.

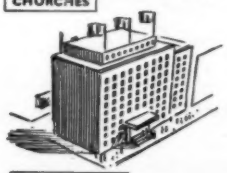
We make them in any quantity, in ivorine, plastic, brass, enamelled bronze, aluminium, and other metals. If you require engraved nameplates of any size, in any quantity, ask us to submit samples and suggestions.


SHIPS

for **ENGRAVED NAMEPLATES—**

CHURCHES

OFFICES


INSTITUTIONS

THEW OF GATESHEAD ON TYNE

SPECIALISTS IN NAMEPLATES FOR THE ENGINEERING AND ELECTRICAL TRADES

EDWARD H. THEW LTD., 1 FIRST AVENUE, TEAM VALLEY TRADING ESTATE, GATESHEAD-ON-TYNE 11

what, no nuts? . . .

Nuts to use nuts? Well, not exactly, but the fact that the Tapping Screw obviates the use of nuts is just one of its distinct advantages over the conventional Machine Screw. There's the saving in time to consider too. And cost. And there's no doubt whatever that the tapping screw makes for a better job all round. With its self-locating point the tapping screw forms its own thread thereby eliminating a separate and expensive tapping operation. Obviously it makes for easier assembly, is stronger, cheaper and faster. Safer too when the Phillips recessed head is specified, designed for power driving without damage to worker or job. You'll be well advised to change over to Tapping Screws. Nothing nuts about that !

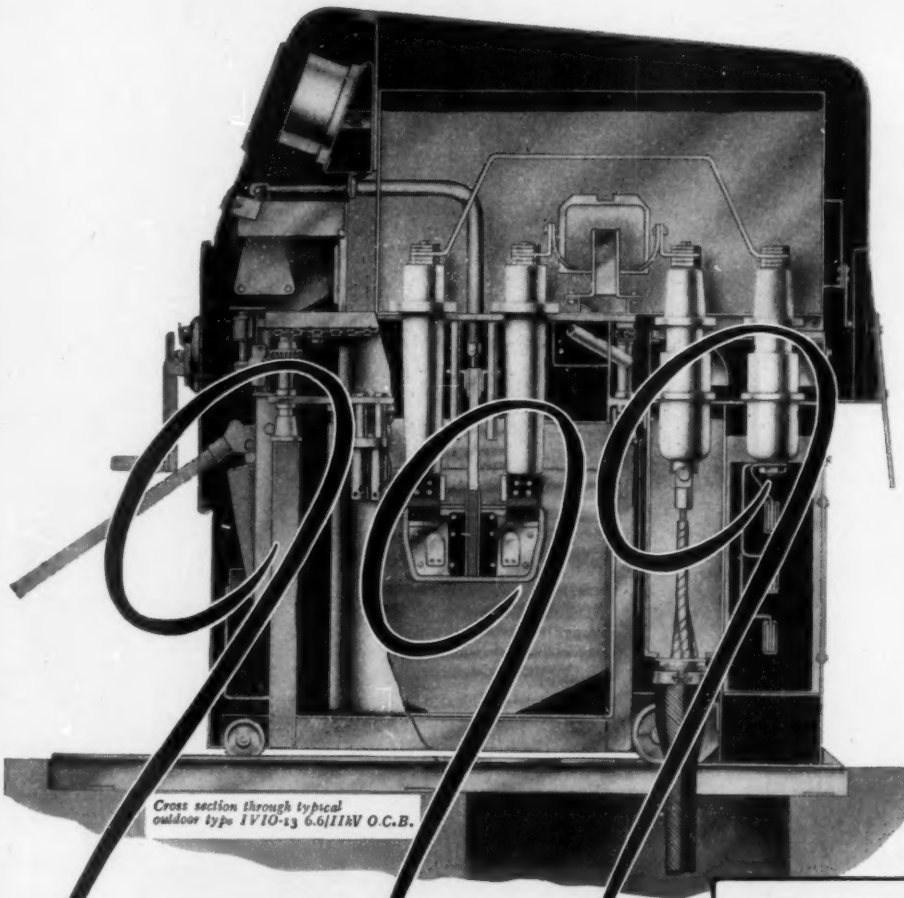
Linread

LINREAD LTD. COX ST. BIRMINGHAM 3

SLOTTED AND PHILLIPS RECESSED HEAD MACHINE SCREWS AND TAPPING SCREWS • HIGH TENSILE HEXAGON HEAD BOLTS AND SETSCREWS AIRCRAFT BOLTS, SCREWS AND RIVETS • SEMS • RIVNUTS • CUSTOM DESIGNED COLD FORGED FASTENERS • ALEX SCREWPLUGS.

Only YS *switchgear has all these ....*

1907 *Golden Jubilee* 1957



Cross section through typical outdoor type IVIO-13 6.6/11kV O.C.B.

999

Spring **A**ssisted **M**anual closing

Arc **T**rap (Arc Control Device)

Inverted **V**ertical **I**solation

AND — AN OUTDOOR DESIGN

proved by over 10 years service throughout the world.

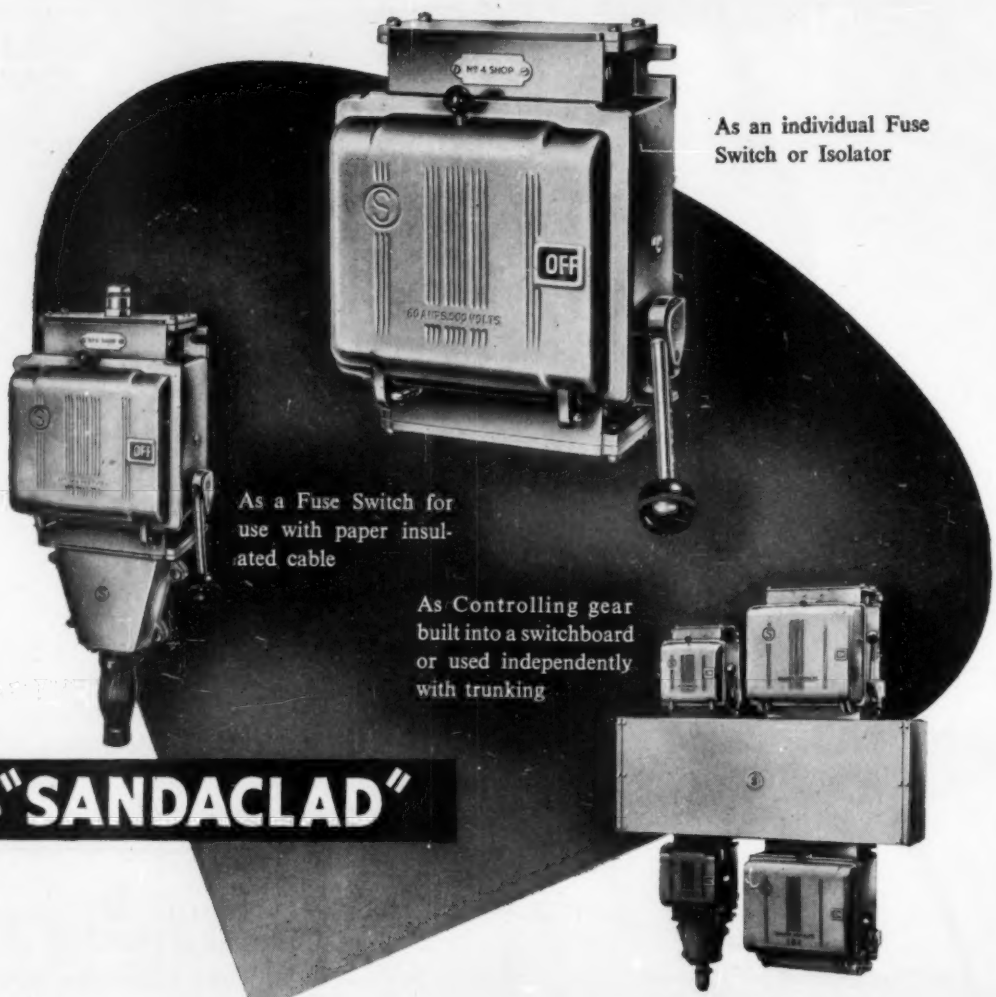
Your Symbol for reliability...

Yorkshire Switchgear

AND ENGINEERING CO. LTD.
MEANWOOD, LEEDS 6
Tel. Leeds 57121/5

London: Grand Buildings, Trafalgar Square, W.C.2. Telephone Whitehall 3530
Associated with Electro Mechanical Mnfg. Co. Ltd., Scarborough

so **MANY** *applications . . .*



As an individual Fuse Switch or Isolator

As a Fuse Switch for use with paper insulated cable

As Controlling gear built into a switchboard or used independently with trunking

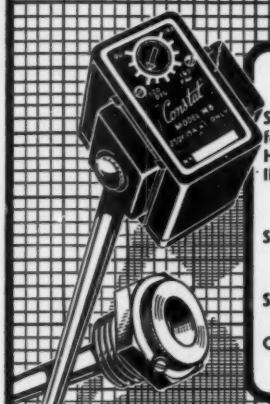
The "SANDACLAD"

All these facilities and more just with the standard product straight off the shelf

SANDERS
WEDNESBURY

WM. SANDERS & CO. (WEDNESBURY) LTD., WEDNESBURY, STAFFS.

'Constat' CONTROLLERS



MODEL "MB"

STEM TYPE THERMOSTAT for control of IMMERSION HEATERS, PLATENS, DRYING OVENS, Etc.

Suitable for 15 amps, 250 V. A.C. only.

Standard Instrument 11" stem with ½" B.S.P. pocket.

Standard range 90/190° F and 30/90° C.

Other lengths and scales available

THE THERMOSTATIC CONTROLS Co.
AVENUE ROAD-HAMPTON-MIDDX.
TELEPHONE: MOLESEY-3285/7

Protect Life - with safety at his elbow -

See that your workmen are fully protected by supplying power through a Davenset Low Voltage Transformer.

Davenset double wound transformers with screened primaries and centre tapped secondaries are available in sizes 75 VA-1,100 VA for low voltage, hand tools and handlamps.

DAVENSET

Available ex stock

LOW VOLTAGE TRANSFORMERS
protect life—
PARTRIDGE, WILSON & CO. LTD., DAVENSET ELEC. WRKS., LEICESTER

YEARS AHEAD IN DESIGN!

ACROW DEMAG

WORLD'S MOST RELIABLE HOIST BLOCKS

The 'Bantam' — 2½, 5 and 10 cwt.

One example of our wide range.

Also available with Creep Speed

Send for illustrated brochure 117

ACROW (Engineers) LTD., South Wharf, London, W.2. AMR 3456 (20 lines)

SOLE AGENTS FOR THE UNITED KINGDOM

BLEECO

VERTICAL
FLUORESCENT FITTINGS
for STREET LIGHTING

MODEL 3
Ornamental Unit for Group A Lighting in Town Centres and Similar Situations.

- Designs available for any combination of lanterns (2, 3 or 4).
- Each lantern accommodates four 2ft 40w tubes.
- The centre sphere is a spigot cap suitable for any diameter spigot and can be easily fitted to existing columns.

ALL FITTINGS COMPLETE WITH GEAR

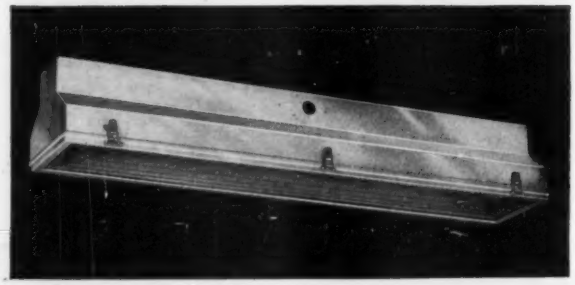
BLEECO LTD.
35 Wellington Road
Brighton 7. Phone: BRIGHTON 24661

First Choice

Model EP.802
TWIN 80 WATT
Suspended or Ceiling Fitting with Opal Fluted "Perspex" Diffusing Cover

Britain's best range of Fluorescent Fittings selected for efficient lighting by famous concerns all over the world.

Model VP.802
TWIN 80 WATT
Industrial Vapour-proof Totally Enclosed Fitting suitable for internal or external application.



UTILAIR

Fluorescent Lighting Fittings and Accessories

UTILITIES (LONDON) LTD.
435-437 BRIXTON ROAD, LONDON, S.W.9
Phone: Brixton 6811/2/3

ZENITH
(REGD. TRADE-MARK)

Insulation
FLASH TEST EQUIPMENT
with the unique safety test prods

Equipped with "VARIAC" primary control giving continuous H.T. voltage regulation from zero to maximum. Standard outputs up to 2,000 volts and 3,000 volts.

Illustrated brochure free on request.

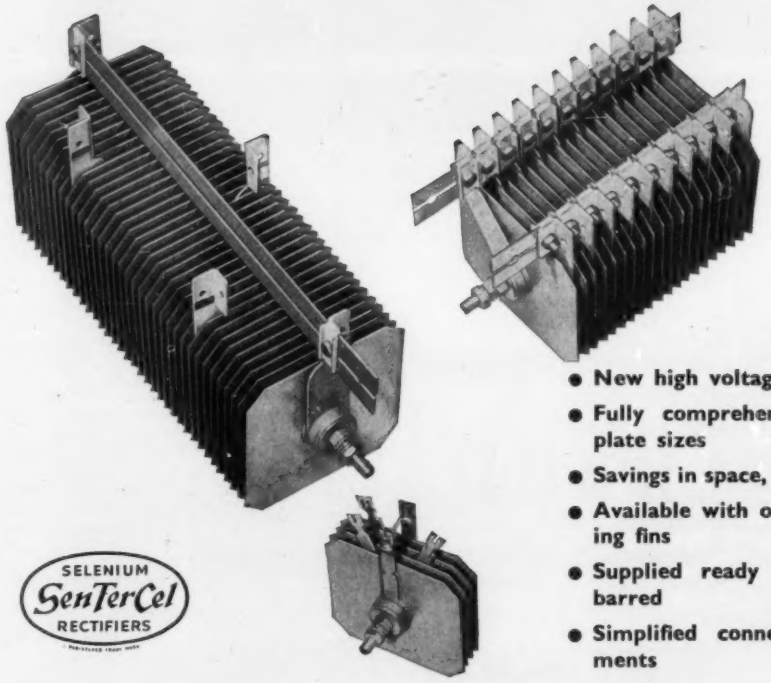
THE ZENITH ELECTRIC COMPANY LTD.
ZENITH WORKS, VILLIERS ROAD, WILLESDEN GREEN, LONDON, N.W.2
Telephone: WILlesden 6581-5 Telegrams: Voltsohm, Norphone, London
MANUFACTURERS OF ELECTRICAL ENGINEERING PRODUCTS INCLUDING RADIO AND TELEVISION COMPONENTS

Introducing SenTerCel series 400 RECTIFIERS

The introduction of this new type of rectifier into the *SenTerCel* range constitutes an important advance in the selenium rectifier field both in manufacturing technique and in resultant savings in space, weight and cost.

A new range of high voltage rectifier plates of square format (with or without cooling fins) and simplification of connecting tag positions offer the rectifier equipment designer a new source of economy and flexibility in design.

The SERIES 400 range incorporates the usual *SenTerCel* facility of rectifier stacks supplied ready wired or bus-barred and provision is made for lateral or longitudinal connections to the bus-bar terminations.



SELENIUM SenTerCel RECTIFIERS

- New high voltage plates
- Fully comprehensive range of plate sizes
- Savings in space, weight and cost
- Available with or without cooling fins
- Supplied ready wired or bus-barred
- Simplified connection arrangements

Write for Advance information leaflet

another advance by Standard

COMPONENTS STC GROUP

Standard Telephones and Cables Limited

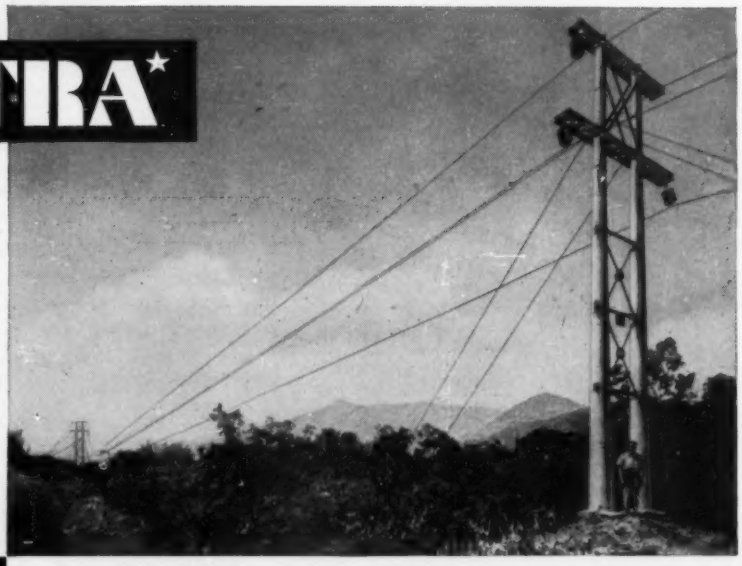
Registered Office: Connaught House, Aldwych, London, W.C.2

RECTIFIER DIVISION: EDINBURGH WAY · HARLOW · ESSEX

HANDSLITE
HANDSLITE
YOUR GUARANTEE OF FIRST CLASS LIGHTING EQUIPMENT
Harris & Sheldon (Electrical) Ltd.
COMPLETE LIGHTING SPECIALISTS & MANUFACTURERS OF LIGHTING FITTINGS & CONTROL GEAR
HEAD OFFICE AND SHOWROOMS — RYDER STREET, BIRMINGHAM, 4
London Phone: GERRARD 0869/0860 — Nottingham Phone: NOTTINGHAM 53630 — Birmingham Phone: CENTRAL 6272-5

specify

ADASTRA



For overhead high tension cables, street lighting columns or floodlight structures *Adastra* steel poles are the logical answer.
Sections of each pole are nested together for ease of transport. Hot dip galvanised for durability, *Adastra* poles are easily installed and require little maintenance.

Adastra products include :—Sectional tubular metallic poles for overhead electric powerlines, and telecommunication lines. Street lighting columns, floodlighting structures, radio masts, flagpoles, sign supports, etc. Specialists in quantity production of welded metal cylinders.

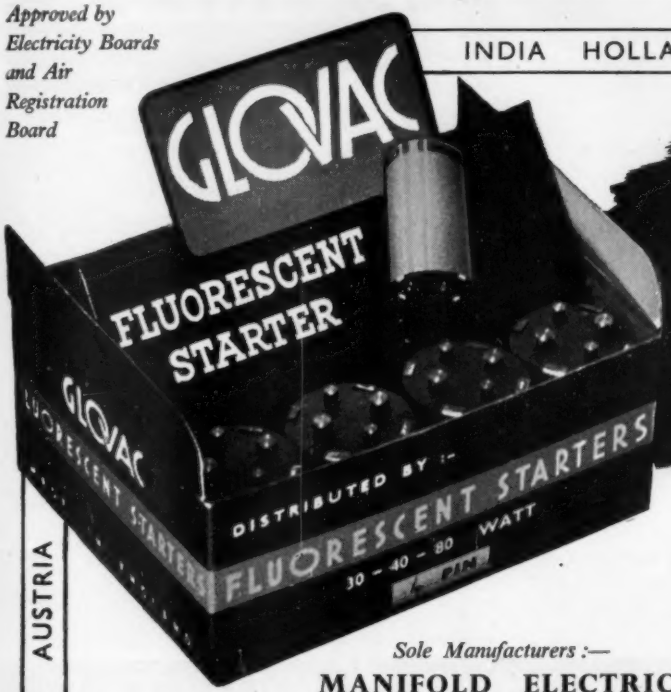
POLES LTD

TYBURN RD · ERDINGTON · BIRMINGHAM 24 · Tel: ERDington 1616
London Office: 98 PARK LANE W.1. Tel: MAYfair 3074

CONSTRUCTORS GROUP

Approved by Electricity Boards and Air Registration Board

INDIA HOLLAND FRANCE ADEN CEYLON AUSTRALIA NEW ZEALAND



THE GUARANTEED STARTER IN WORLD-WIDE USE

Ceramic condensers on heavy duty types and solid brass contacts ensure long life and trouble-free operation even in tropical conditions.

Sole Manufacturers :—

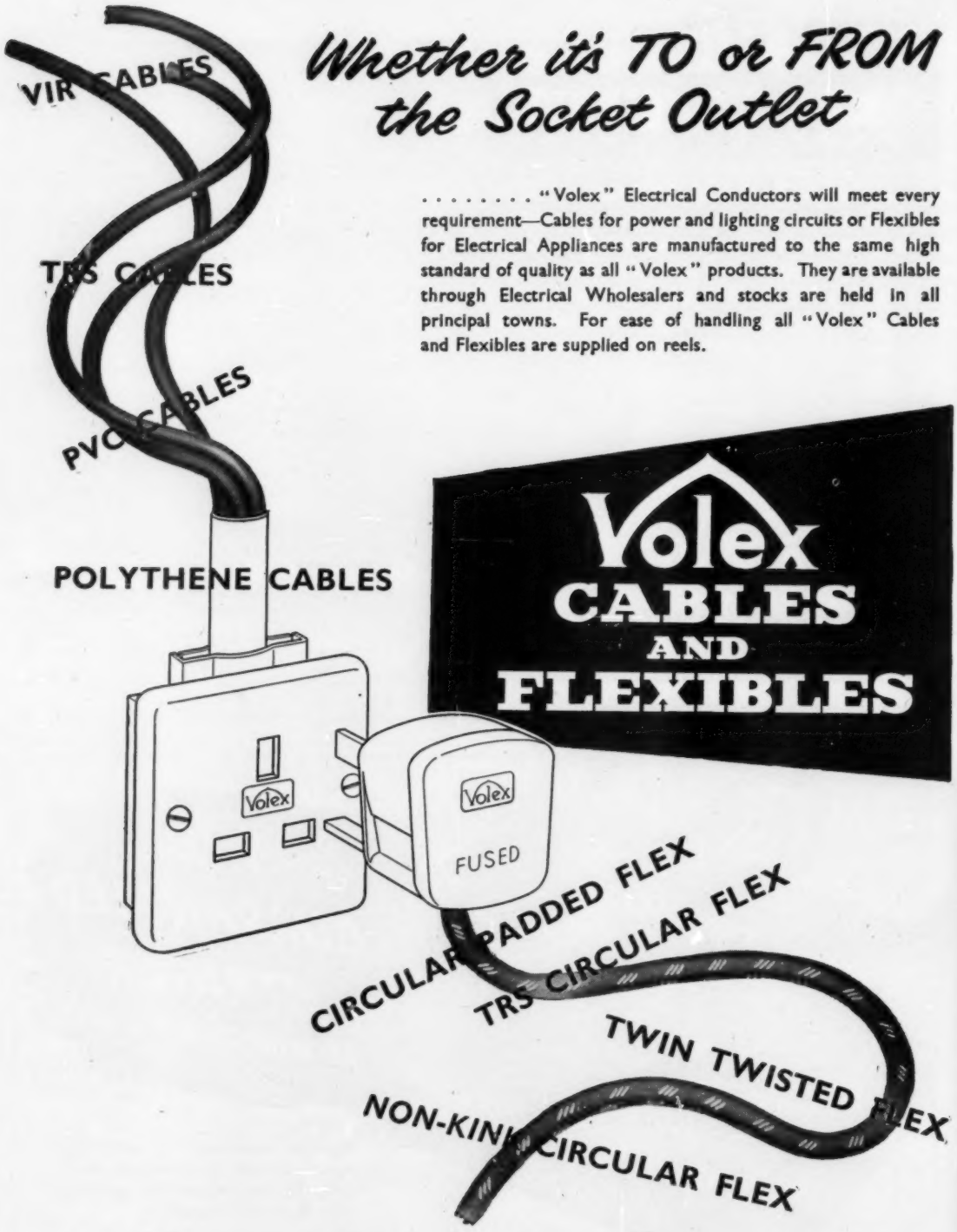
MANIFOLD ELECTRIC CO. LTD.

124 ST. MARGARETS ROAD, TWICKENHAM, MIDDX. POP. 6496

ISRAEL AUSTRIA PORTUGAL ITALY ARGENTINA SOUTH AFRICA

Whether it's TO or FROM the Socket Outlet

. . . . . "Volex" Electrical Conductors will meet every requirement—Cables for power and lighting circuits or Flexibles for Electrical Appliances are manufactured to the same high standard of quality as all "Volex" products. They are available through Electrical Wholesalers and stocks are held in all principal towns. For ease of handling all "Volex" Cables and Flexibles are supplied on reels.



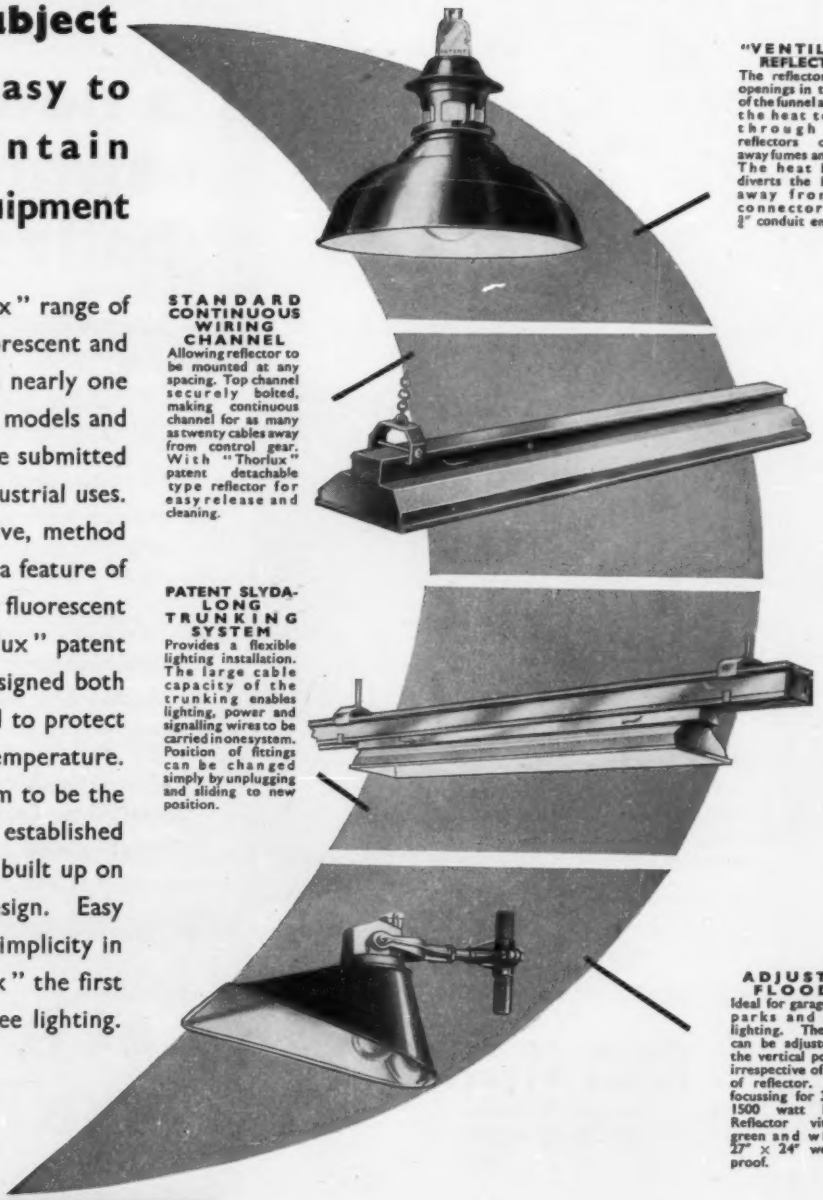
Volex VOLEX ELECTRICAL PRODUCTS LTD
SALFORD 6

Telephone: PENdleton 4373 Telegrams: "VOLEXPROD", Salford 6

C

throwing light on the subject —of easy to maintain lighting equipment

The "Thorlux" range of reflectors for fluorescent and tungsten lamps covers nearly one hundred standard models and special designs can be submitted for all industrial uses. The simple, yet effective, method of detaching is a feature of both tungsten and fluorescent fittings. The "Thorlux" patent wiring box is designed both for easy wiring and to protect the cables from high temperature. We do not claim to be the cheapest but to have established a reputation built up on quality and design. Easy maintenance and simplicity in use make "Thorlux" the first name for trouble free lighting.



"VENTILUX" REFLECTOR
The reflectors have openings in the side of the funnel allowing the heat to rise through the reflectors carrying away fumes and dust. The heat baffle diverts the hot air away from the connector box. ¾" conduit entry.

STANDARD CONTINUOUS WIRING CHANNEL
Allowing reflector to be mounted at any spacing. Top channel securely bolted, making continuous channel for as many as twenty cables away from control gear. With "Thorlux" patent detachable type reflector for easy release and cleaning.

PATENT SLYDA-LONG TRUNKING SYSTEM
Provides a flexible lighting installation. The large cable capacity of the trunking enables lighting, power and signalling wires to be carried in one system. Position of fittings can be changed simply by unplugging and sliding to new position.

ADJUSTA-FLOODS
Ideal for garages, car parks and flood-lighting. The lamp can be adjusted to the vertical position irrespective of angle of reflector. With focussing for 300 to 1500 watt lamps. Reflector vitreous green and white, 27" × 24" weather proof.

THORLUX
REGD
THROWS LIGHT ON INDUSTRY

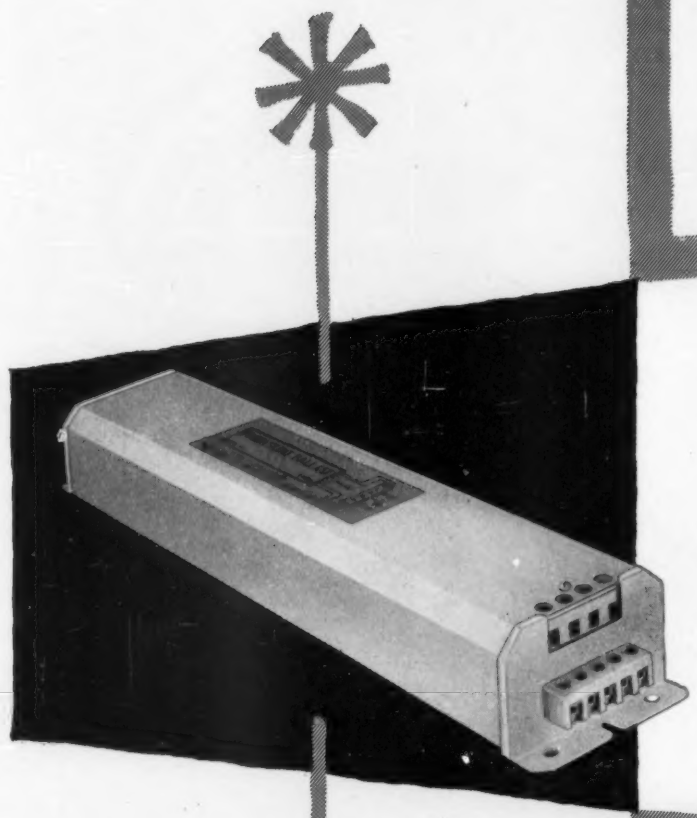
INDUSTRIAL LIGHTING EQUIPMENT

IMPORTANT *We are proud of our share in developing the "Overlamp" type of reflector. Our patented detachable trough is also rapidly becoming as popular in industry. Comprehensive Catalogue ER 1057 covering complete range sent on request.*

F. W. THORPE LTD. WELBY RD., HALL GREEN, BIRMINGHAM 28. *Springfield 3318-19-10. Grams: THORLUX, B'ham*

D

a new twin tube ballast



This new type MIDCOIL Twin Tube Ballast is designed to operate two 5 ft 80 watt tubes.

The Unit is a Transformer Start Ballast for use in conjunction with a 6.8 MFT 440 Volt Series Capacitor operating tubes as series pairs and becomes inoperative if either tube fails. Available Bitumen filled or Bitumen free.

Supplied as Twin 80 choke (EW2/80) and Twin Starter (S2/80) or combined unit (EB2/80). This Unit considerably extends tube life and is marketed at £4.10.0 list. Delivery 7 to 10 days.

Phone or write for full particulars.

TESTED TO OVER 50,000 STRIKES on 25 seconds switching cycle

at half the cost!

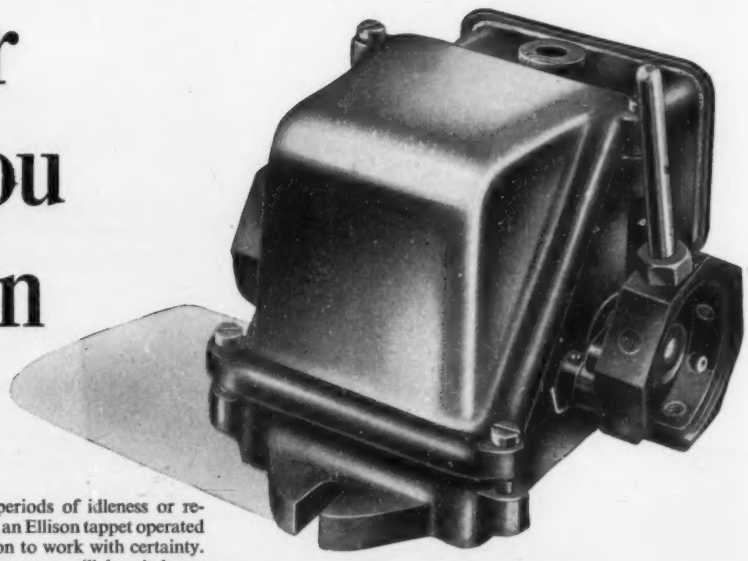
'MIDCOIL'

THE MIDLAND COIL WINDING CO. LTD.

4, LANCASTER STREET, BIRMINGHAM, 4. *Phone: ASTon CROSS 1011*

Idle...

but never lets you down



Whether intended for long periods of idleness or required for frequent operation, an Ellison tappet operated limit switch can be relied upon to work with certainty. In that moment of emergency, you will be glad you fitted "Ellison".

Write for list No. 11 for details and illustrations of the Ellison range of limit switches and emergency trip switches.

ELLISON SHUNT LIMIT SWITCH (AC OR DC)

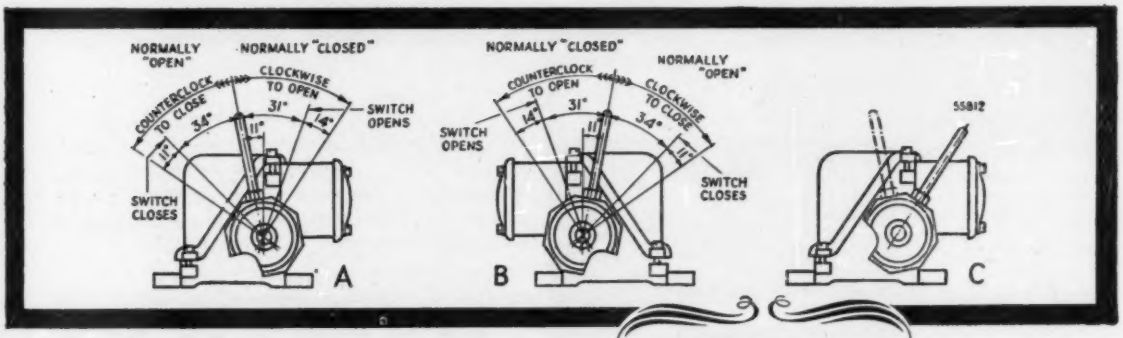
Maximum current carrying capacity of 40 amps continuously.

Breaking capacity at 440 volts of 10 amps non-inductive DC and 80 amps AC for single-pole and approximately three times these figures for double-pole. Available as Industrial, Watertight and Flameproof patterns.

ROTATION OF OPERATION OF SHUNT LIMIT SWITCHES

Sketches A and B show how the motion of a Shunt Limit Switch is reversed by turning the switch round and changing over the tappet to the other hub. Sketch C shows how a "normally closed" Shunt Limit Switch, with clockwise to "open" operation, is converted to "normally open", counter-clockwise to "close", by interchanging the springs and transferring the tappet to the position indicated by dotted lines. By turning the switch round as Sketch B, the operation can be converted to clockwise to "close".

The hub-springs of the Watertight and Flameproof Switches are inside the cases and it is necessary to substitute new springs when required to change from "normally closed" to "normally open".

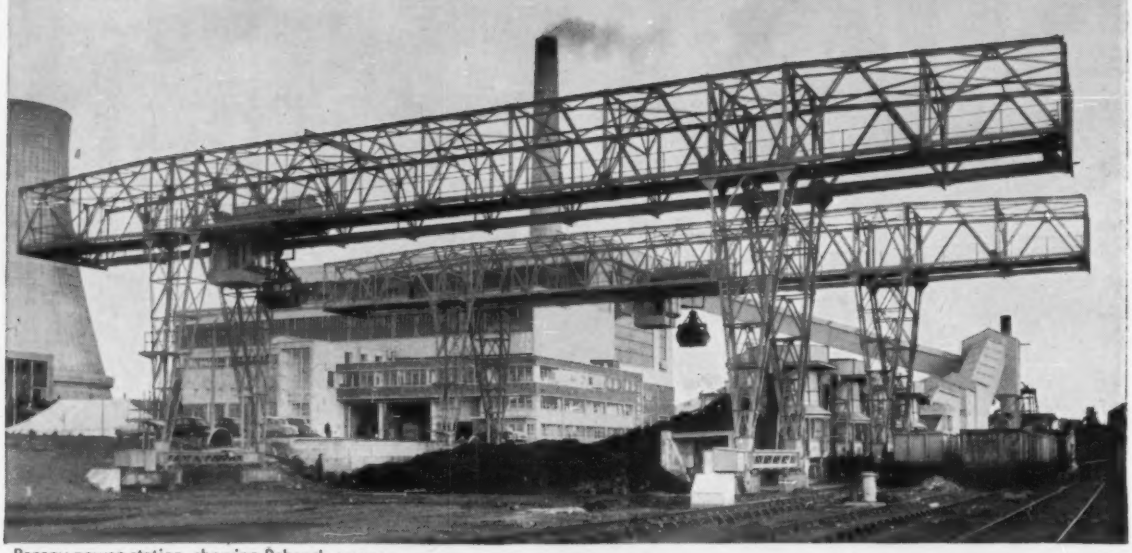


YOU CAN RELY ON AN ELLISON PRODUCT

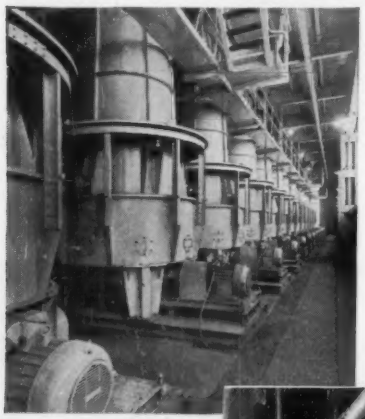
TRADE (E) MARK
GEORGE ELLISON
LIMITED
BIRMINGHAM ENGLAND

762/G129

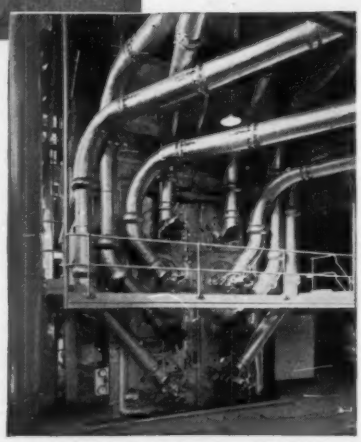
POWER from colliery "waste"



Barony power station, showing Babcock cranes, rotary hoppers and fuel conveyor system.



Line of Babcock rotary hoppers for handling slurry to the drying and pulverizing mills feeding the boilers.



P.F. burners and fuel piping on one of the boilers.

The whole of the boiler plant for the new Barony power station (South of Scotland Electricity Board), comprising four 150,000 lb./hr. pulverized-coal-fired boilers, and the whole of the coal and ash handling equipment, are of BABCOCK design and manufacture.

Outstanding feature of this installation is its ability to use as fuel, "washery-slurry"— a wet, putty-like and previously unusable by-product of the coal-washing plants.

This has been made possible through the development by Babcock & Wilcox of new, economic methods and equipment for the handling and preparation of "washery-slurry" for use as a boiler fuel — one of many BABCOCK contributions to national fuel economy.

BABCOCK

STEAM-RAISING PLANT AND MECHANICAL-HANDLING EQUIPMENT

BABCOCK & WILCOX LTD

BABCOCK HOUSE, 209 EUSTON RD., LONDON, N.W.1

3 JANUARY
1958

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

In This Issue

Ten Years of Nationalisation 1
On 1st January the Central Electricity Authority handed over the electricity supply industry to the new Electricity Council and Generating Board. The new arrangements are commented on

Progress Under Nationalisation 3
A survey of the work of the Central Electricity Authority and Area Boards during the past ten years showing how a more than doubled demand has been met, with a relatively small increase in the numbers employed and in the charges to consumers

Lord Citrine 6
An appreciation of the work of the Chairman of the Central Electricity Authority from its inception to the end of last year, with a portrait in colour

Electricity Act 9
The principal features of the new measure are set out and photographs of members of the Electricity Council and Central Electricity Generating Board are reproduced

Alternator Ventilation 11
The author outlines the various systems which have been developed for cooling large turbo-alternators

Busbars and Busbar Connections 27
Review of the recently published revised edition of B.S. 159

Electronics in Heavy Industry 30
Until recently the use of electronics in heavy industry was limited to simple temperature indicators and the control of very small motors. The author shows that nowadays electronics is deeply involved with heavy industry and that new developments in electronic measuring and control techniques have kept pace with industry's requirements

European Common Market 36
A statistical summary of electrical trade among the six "Messina" countries and between them and the United Kingdom. As well as totals, trade in the principal groups is analysed

✧ ✧ ✧ ✧

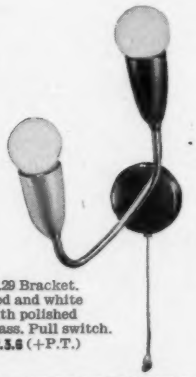
Overseas Electrical Trade 15
New Year Honours 17
Personal and Social 18
Parliamentary Report 22
Views on the News 23
Industrial News 24
Electrical Contracting Apprenticeship 29
Electrical Research Reports 37
Letters to the Editor 38
Shippingport Nuclear Power Station 39
Engineers as Managers 40
Generation and Development 41
New Electrical Equipment 42
Financial Section 44
Next Week's Events 47
New Patents 48
Contract Information 49
CLASSIFIED ADVERTISEMENTS 93
INDEX TO ADVERTISERS 104

VOLUME 162 NUMBER 1 ✧ *Eighty-Sixth Year of Publication* ✧ FRIDAY PRICE 1s 6d

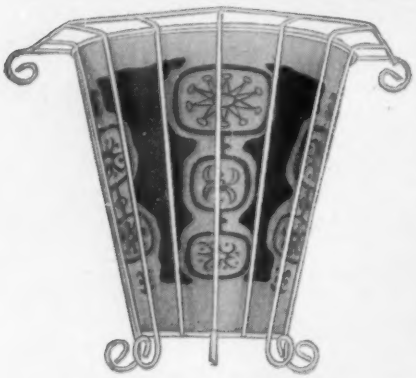
Editorial, Advertising and Publishing Offices: Dorset House, Stamford Street, London, S.E.1. Telegraphic Address: "Elecrev, Sedist, London." Code: ABC. Telephone No. Waterloo 3333 (60 lines). Registered at the General Post Office as a Newspaper. Entered as Second Class Matter at the New York, U.S.A., Post Office. Annual Subscription: Home £4 15s 0d; Overseas £5 15s 0d: U.S.A. and Canada $16.00. Cheques and Postal Orders (on Chief Office, London) payable to ELECTRICAL REVIEW PUBLICATIONS LTD. and crossed "Lloyds Bank."

NEW to brighten up your winter selling Berry's LIGHTING FITTINGS

Now that the winter evenings are here, and the need for indoor lighting is at its height, Berry's introduce a new range of contemporary designs.
Here is a big selling opportunity—seize it by displaying these new, contemporary Berry's lighting fittings!



M.29 Bracket. Red and white with polished brass. Pull switch. £2.3.6 (+P.T.)



M.22B/G.7B "Pin-up" wall bracket, hung like a picture 21/- (+P.T.)

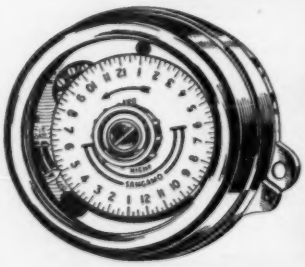
M.30 Pendant for Standard or 15 mm. B.C. lamps £8.4.0 (+P.T.)

DESCRIPTIVE LEAFLET

Write now for your copy of this new leaflet, showing Berry's latest range of contemporary lighting fittings.

Berry's

BERRY'S ELECTRIC MAGICOAL LTD.
Touchbutton House, Newman Street, London W.1. (Museum 6800)



SANGAMO TIME SWITCHES

The superiority of Sangamo Time Switches, both in design and performance, has been established over more than twenty years of intensive world service. In addition to 24 hour-dial switches, Solar Dial, Short Interval and Change-over types are also available. Advice and particulars of the entire range of Sangamo synchronous Time Switches will gladly be supplied on application.

SINGLE PHASE AND POLYPHASE WATT-HOUR METERS
SYNCHRONOUS TIME SWITCHES
SYNCHRONOUS MOTORS AND MOTOR UNITS

SANGAMO WESTON

PANEL & SWITCHBOARD INSTRUMENTS
D.C. Moving Coil, A.C. Rectifier, H.F. Thermocouple, A.C./D.C. Moving Iron
PORTABLE INSTRUMENTS
D.C. Moving Coil, A.C. Rectifier, H.F. Thermocouple, A.C./D.C. Moving Iron, A.C./D.C. Dynamometer
LABORATORY STANDARD INSTRUMENTS
D.C. Moving Coil, A.C./D.C. Dynamometer

CURRENT TRANSFORMERS · FREQUENCY METERS · ALL-PURPOSE TEST SETS AIRCRAFT INSTRUMENTS · RATIOMETERS ELECTRICAL THERMOMETERS · WESTON STANDARD CELLS · TACHOMETERS "PHOTRONIC" PHOTO ELECTRIC CELLS PHOTOMETERS

SANGAMO WESTON LIMITED
ENFIELD · MIDDLESEX
Telephone: ENField 3434 (6 lines) & 1242 (6 lines) Grams: Sanwest, Enfield

Scottish Factory: Port Glasgow, Renfrewshire
Port Glasgow 41151

Branches: London, CHAncery 4971
Glasgow, Central 6208 · Manchester, Central 7904
Newcastle upon Tyne, Newcastle 26867
Leeds, Leeds 30867 · Liverpool, Central 0230
Wolverhampton, Wolverhampton 21912
Nottingham, Nottingham 42403
Bristol, Bristol 21781
Southampton, So'ton 23328
Brighton, Brighton 28497

ELECTRICAL REVIEW

3 January 1958 Vol. 162 No. 1 Established 1872

Ten Years of Nationalisation

ABOUT ten years ago the electricity supply industry of Great Britain (excluding the North of Scotland, already under a public board) was nationalised, following the nationalisation of coal mining and transport and followed very shortly by the nationalisation of the gas industry. Legislators, however, were not satisfied with the initial prescription and further treatment was considered necessary. A few years later the South of Scotland was amputated from the main body, and last year a further major operation was carried out which gave rise to the organisation which started work this week. Whether the patient's continued healthy progress was due to the skill of the surgeons or to his own inherent vitality is open to question. What may reasonably be hoped is that the legislators will now turn their attentions elsewhere and that the electricity supply industry will have a clear run of operation under the new administrative machinery before any further drastic changes are made in its structure.

Ten years is not a long time in the history of an industry, even so young a one as electricity supply, but in this decade a substantial revolution has been successfully carried out. Without any break in the rapid and continued growth, a complete change-over has been effected not only in ownership and management but in the whole distribution structure.

As we point out on page 3 the new organisation starts with a number of advantages over the old. On the generation side it inherits a much smaller "gap" between capacity and potential demand, whilst the division now made between responsibility for generation and central direction should enable engineering and policy decisions to be separated, with some saving of high-level manpower. There has also been a separation of operation and construction, as we showed in our leading article of 13th December. The running of the system is being placed by the Central Electricity Generating Board in the hands of five Regional Executive Committees. At the same time the responsibility for the construction of power stations is to be taken over by three Engineering Project Offices. On the distribution side the major work of reconstruction and consolidation has been carried out, and the same Area Boards will administer the same areas as before with slightly greater powers.

Many problems remain, notably how to fit new forms of generation into the old framework, and how to secure the fullest possible use of all equipment both conventional and nuclear. But in wishing good luck to the newcomers in these and other tasks we should not forget to thank all those who have pioneered electricity nationalisation during this decade and provided a sound basis for the latest development.

ALTERNATOR COOLING SYSTEMS

During recent years the overall thermal efficiency of generating plant has been improved largely by building turbo-alternators of increasingly high outputs. Although the size of turbo-alternators can be increased, theoretically, almost indefinitely, there are limits due to mechanical, physical and transport considerations. Because of the transport regulations prevailing in this country we cannot build machines which are physically larger than the 100 MW units of immediate post-war design. British manufacturers are thus restricted in frame size and the only limitation on machine output is a thermal one.

The problem of increasing the output of generating plant resolves itself largely into one of removing heat from the alternator windings. As Mr. V. Easton shows in this issue the increase in output of single-shaft turbo-alternators has risen from 60 MW in 1949 to the 275 MW machines at present under consideration, and although this increase in size has been dictated primarily by economic factors, from the technical standpoint it has been made possible only by improvements in ventilation.

ELECTROGYRO LOCOMOTIVES

Although the electrogyro locomotive is not particularly new and has seen experimental service in various parts of the world it has never been adopted on any scale. Renewed interest is, however, attached to these novel locomotives in view of the experiments which are at present being conducted by the National Coal Board to determine whether they offer any advantages over the more conventional mine locomotives. The machine being tested by the N.C.B. is a surface shunting locomotive in which energy is stored in two flywheels, each of which runs in an atmosphere of hydrogen and is combined with a squirrel cage induction motor.

If the system and the equipment prove themselves both technically and economically it is intended to build a flameproof underground locomotive. Because the operating cycle of the electrogyros corresponds closely to a haulage duty of a short run followed by a stop this type of motive power would appear to offer the possibility of hauling underground trains with improved efficiency.

END OF B.I.F.

In our leading article of 20th December we referred to an announcement by the Birmingham Chamber of Commerce that it would no longer be responsible for a British Industries Fair on the basis of previous Fairs. We expressed the opinion that it was doubtful if the Fair would ever be revived. In this we were justified for a few days later the Chamber of Commerce decided to wind up its Castle Bromwich activities.

The chairman of the Fair Committee, Mr. E. M. Clayson, attributed the decline in interest on the part of British manufacturers to, among other things, the lack of leadership at the national level in favour of a general fair embracing all industries. He also acknowledged the influence of the promoters of specialised exhibitions which had resulted in the majority of industrialists approached by the F.B.I. registering a vote in favour of such exhibitions.

We may repeat our regret at the demise of the British Industries Fair which was once a power for good. But we recognise the force of the arguments against its continuance and the necessity for fully supporting those exhibitions in which the electrical industry is largely represented and particularly the industry's own show—the Electrical Engineers' Exhibition.

JHELUM DAM

The earth dam to be constructed on the River Jhelum (Pakistan) to the designs and under the supervision of British consulting engineers has irrigation as its main function, but it will no doubt serve other purposes as well. One of these is reported to be the supply of electricity from a 300 MW hydro-electric station. The proportion of the total capital expenditure of £50 million that can be equitably allocated to generating electricity would seemingly give a lower cost per kW than is usual for such stations, assuming it to be worked out in accordance with the principle suggested by Messrs. J. K. Hunter and A. W. Pedder at the World Power Conference last summer (*Electrical Review*, 5th July).

This method provides that while the capital cost incurred solely for one service should be charged to that service, the costs common to all services should be allocated in proportion to the hypothetical alternative expenditure that would have been incurred if each had been dealt with alone.

INDUSTRIAL ELECTRONICS

Not many years ago most engineers in heavy industry regarded electronic devices and equipment as being delicate and not too reliable. As Mr. Ettinger points out in an article which we publish in this issue, the use of electronics in heavy industry at that time was limited to simple temperature indicators and to the control of the smallest electric motors. This state of affairs has now changed and post-war developments in electronic measuring and control techniques, coupled with more limited uses of high power electronic processing equipment, have kept pace with the increasingly stringent requirements of modern industry. Electronic equipment has now become accepted as part and parcel of most industrial control systems. Indeed, many industrial processes would not be possible without the fine degree of control which can only be provided electronically.

WASH BOILERS

Complementary to the survey of domestic washing machines in our 20th December issue, next week (10th January) we shall be publishing particulars of the range of wash boilers now on the market, with details of size, tub capacity, loading, method of control, finish and price. A number of the models will be illustrated. On 31st January spin and tumbler dryers will be dealt with

Progress Under Nationalisation

ELECTRICITY SUPPLY IN THE LAST DECADE

NEW Year's Day saw the start of a new organisation of electricity supply in England and Wales. The Area Boards were exactly ten years old on that day: the Central Authority was a few months older, whilst vesting day itself was three months later. The industry has therefore now experienced nearly ten years of nationalised operation, and this seems a fitting moment to review some of the progress that has been made and to compare the present position with the pre-vesting situation.

The organisational changes are obvious and hardly need stressing at this date. Approximately 560 independent undertakings and nearly this number of separate distribution systems were merged into a handful of supply authorities served by an even smaller number of generating authorities. Methods of charging and conditions of supply have been standardised if not unified over most of the country. Many of the anomalies—and some of the inefficiencies — resulting from piecemeal distribution areas have been eliminated. But what has happened to the business of the industry whilst all these changes have been taking place? How has it grown, what economies have been effected, and how far has it responded to the increasing national demands made upon it?

Whilst these questions cannot be answered briefly, some light can be thrown on them by recounting certain of the growth figures and illustrating some of them graphically. Any such survey should naturally start with generation, not only because that is the commencement of the supply process itself but because the whole industry must primarily stand or fall by the adequacy of its generating capacity.

Demand and Generating Capacity

Vast as was the organisational problem facing the new authorities they had a more urgent though less spectacular task to perform, namely to make good the deficiencies of the war years in the face of steadily mounting requirements. New administrative machinery had to be devised, but in the meantime the old machinery had to be kept going, and much of this was creaking badly at the joints owing to insufficiency of that vital lubricant—capital investment. All through the war investment in new equipment had necessarily been kept to the minimum, and, in particular, the growth of generating capacity had lagged dangerously behind the growth of load.

A year previously, public attention had been focused on the perilously narrow margin on which the country's power stations were operating. The margin in that particular case related to fuel, but the margin of generating capacity was equally narrow and likely to take even longer to build up. With all the will in the world, and even with all the capital in the world, it is impossible to build power stations overnight, and the position at vesting day with the curves of demand and plant construction inclining still farther apart was not only bad but was bound to get worse.

The year-by-year fluctuations in the battle to close the gap are clearly shown in the graphs of Fig. 1, but some explanation is necessary regarding the figures used to show the demand. The general trend of load growth over the last ten years has been an annual increase of approximately 8 per cent both in the energy sold to consumers and in the maximum demand. The ratio between them (and therefore the load factor) has shown no perceptible trend either upwards or downwards. Particular years have, however, shown considerable fluctuations on either side of these general trends, due largely to changes in the weather. For example, last year (1956-57) the winter was unusually mild and instead of the normal increases there was an increase of only about 6½ per cent in energy and an actual decrease of 2½ per cent in the maximum potential demand. The consequence was that for the first time for thirteen years

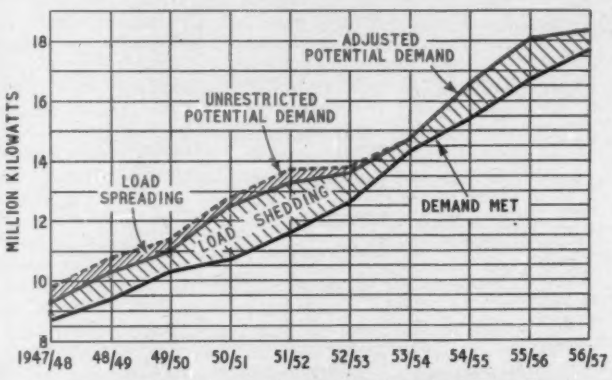


Fig. 1.—How the demand has been met during the past decade

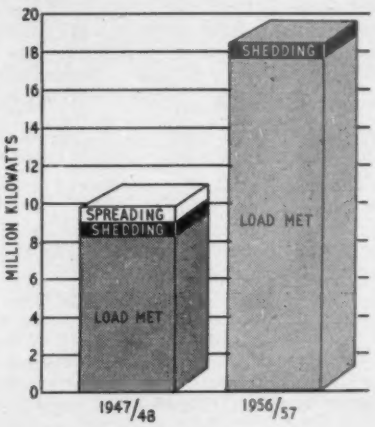


Fig. 2.—The position at the beginning and end of the period

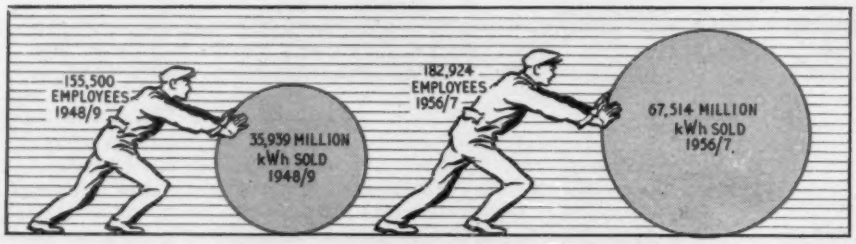


Fig. 3.—Comparison of employees and energy sales in the first and last years of review

the maximum demand in the year was met by the available generating plant without reduction of voltage or frequency or load shedding. This occurrence was, however, largely fortuitous and was no guide to the long-term position.

In order to avoid giving a misleading impression the maximum potential demand plotted in Fig. 1 is adjusted on the basis of a floating average of the load factor over the last three years. The curves show that the gap reached the maximum in the years 1950-51 and 1951-52 at which time the demand actually met was about 16 per cent below the estimated unrestricted demand adjusted in the manner described and allowing for the effect of industrial load spreading. The position then improved as the effect of the accelerated building programme made itself felt, and while there was a slight setback in the period 1954 to 1956 the equivalent figure for the gap in the last year was only about 3½ per cent.

Fig. 2 illustrates the position at the beginning and the end of the period under review. The first column refers to the last year of the old regime whilst the second column shows the position ten years later. Judged by pre-war standards, when a positive standby of reserve generating plant at the time of the yearly peak was regarded as a *sine qua non*, the failure of the nationalised industry to close the gap entirely might be thought to be disappointing. But regarded proportionally and looked at against the background of the relentless increase in demand, and in the light of capital restrictions and other post-war difficulties, to have come so near is a major achievement. While it cannot be said that every potential requirement has been satisfied, the demand actually met has more than doubled in the ten years.

Electricity Sales

Just as generation is the commencement of the supply process the sale of electricity is its aim and end product. The next step is therefore to examine this output, and here one must confess to a certain disappointment. The output of the machine, as measured by sales to consumers, has grown in just about the same ratio as the size of the machine itself, and no more. Approximately twice the capacity of plant, as compared with ten years ago, is now delivering just twice as much energy. The proportional effectiveness of the whole equipment (it would be wrong to call it efficiency) is substantially unaltered.

The index to this effectiveness can be taken either from the ratio of energy to maximum demand (i.e. the load factor) or, in the case of steam stations, from the ratio of mean load to output capacity. The two figures differ but they march in step and tell very much the same tale. It is a tale of year-by-year fluctuations largely due to weather differences but with a general trend as nearly constant as can be seen. Doubtless the work of reorganisation left little opportunity for economic progress in this direction but, whatever the reason, the facts are that the load factor problem has been hardly nibbled at, and the task of making better use of the plant has been left to the new authorities.

When one turns from use of plant to use of personnel the picture is a much brighter one. The regrouping and rationalisation resulting from the merging of so many separate undertakings has enabled a large increase in supplies to be handled by a relatively small increase in staff. Unfortunately, full data in a comparable form are not available for the pre-vesting years, and Figs. 3 and 5 compare only the first and last years of nationalised operation—i.e. their span in years is one less than that of the other diagrams. Fig. 3 represents in semi-pictorial form the sum total of electricity sales being propelled by the total labour force of the industry. The figure on the left represents (by its area) the total employees of the Central Authority and Area Boards in 1948-49 scaled down to show the equivalent figure for England and Wales only. The area of the corresponding figure on the right represents the employees eight years later in the last full year of this management.

The areas of the two circles represent the electricity sold to consumers in the same two years. In round figures the electricity sales increased 1·9 times whilst the employees increased 1¼ times. In comparing these figures it must be borne in mind that the capacity of the equipment (though not necessarily its physical size) which had to be handled by this labour force went up in approximately the same ratio as the sales.

Consumers Served

In the foregoing paragraphs the " output " of the supply industry has been regarded as being represented by the number of kilowatt-hours sold. Another index to the

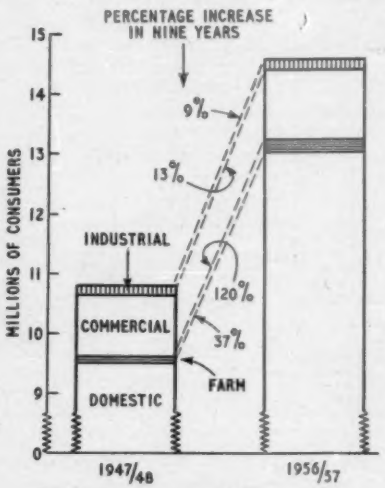


Fig. 4.—Variation in number of consumers during the period

output, hardly less valid, is the number of consumers served. There is this difference, however, that whereas there is no obvious upper limit to the sales there is a saturation point to the number of consumers which is reached when every accessible household, works and establishment is connected to the public mains. It must therefore be taken as a normal and healthy sign when, as in this case, the increase in consumers is proportionally less than the increase in sales. Outstanding progress may, however, be observed in reference to special groups such as rural or farm consumers.

Another difficulty in using growth of consumers as an index of progress is that domestic consumers are always likely to represent nearly 90 per cent of the total number and industrial consumers little more than 1 per cent. Changes in the former group are therefore likely to swamp all other changes unless steps are taken to spotlight the smaller groups. The steps taken in Fig. 4 are to suppress the zero and to show only the upper portions of the columns representing numbers of consumers. The lower portions (relating only to domestic consumers) are in this way compressed whilst the various increases are shown to an exaggerated scale. It will be seen that the small group of farm consumers has increased by 120 per cent and is now nearly two-and-a-quarter times what it was, whilst domestic consumers account for much the greater part of the absolute growth. Taken overall, a consumer increase in the ratio 1·3 over the last nine years (with, of course, an increased consumption per consumer) has been handled within the compass of a staff increase in the ratio 1·25.

Revenue and Expenditure

The final illustration, Fig. 5, is intended to give a broad picture of the financial changes that have taken place. The areas of the two circles represent the total turnover in the first and last years of nationalised operation — i.e. the total receipts from sales of electricity and steam, meter rents and surplus from auxiliary activities. The sectors of the circles show where all this money went to.

The growth shown in this diagram is greater than that represented by the two circles of Fig. 3, for since both sales and mean price per unit have gone up the revenue increase will be the combined effect of these two increases. In figures, a sales increase of 1·9 times has been accompanied by a mean price increase of 1·2 times to give a revenue increase equal to the product of these two ratios, namely, 2·3 times.

The angles enclosed by the sectors represent the proportions of the various outgoings, and it will be seen that fuel accounts for much the largest increase both absolutely and relatively. Moreover, this increase was itself the result of two factors acting in opposite directions, the higher price of fuel and the improved thermal efficiency of the stations. The next sector represents generation working costs other than fuel whilst the third sector labelled "Central" represents expenditure by the Central Authority on administration and general services, rents, insurance and main transmission.

This central expenditure must be looked at in conjunction with the last sector labelled "Distribution." It will be noticed that the proportion of expenditure (represented by the angles) by the Central Authority has increased and that by the Area Boards has decreased, a result which was to have been expected. On the one hand, many of the activities carried out centrally for the industry, such as training and research, take time to establish, and on the other hand, most of the economies resulting from unification would naturally accrue at the distribution end. Expressed proportionally, distribution operations cost about two-thirds what they did.

In the diagram, capital charges are shown for the industry as a whole and are not split between generation and distribution. The proportion of expenditure on interest charges has gone up by one-third, and this must be regarded as the direct consequence of higher interest rates. Depreciation charges on the other hand (including reserves and balances) form exactly the same proportion in the last year as in the first. Payment in lieu of rates has gone up less than proportionally with revenue and hence this sector has narrowed.

Past and Future

The supply industry in England and Wales, whose organisation entered a new phase on 1st January, can look back on ten years of solid accomplishment which should provide a sound basis for this new development.

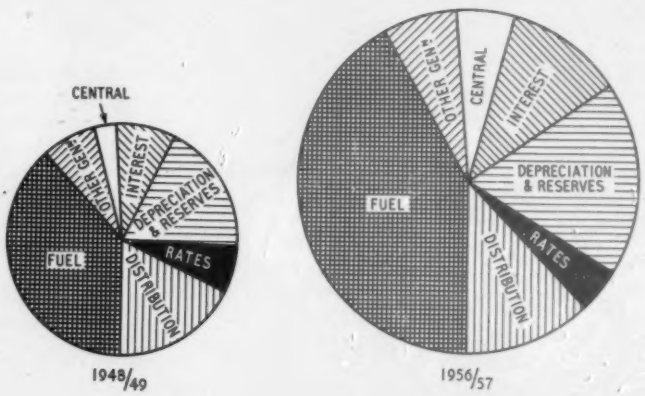


Fig. 5.—Expenditures in 1948-49 and 1956-57 compared

The gap in generating capacity, which was in the neighbourhood of 11 per cent at vesting day, has been reduced to about 3½ per cent. Distribution has been consolidated within the twelve areas of England and Wales and the same Boards will operate the same areas with slightly enhanced powers under the new regime. The percentage increase in the price of the industry's chief product—electrical energy—is much less than that of its raw materials, in particular fuel, and at the same time a start has been made on accumulating a supplementary reserve to set against the increasing prices of plant replacement.

Note.—The figures used in the above statements and diagrams refer specifically to England and Wales only. In some cases totals for the earlier years had to be adjusted to give the equivalents under the later re-grouping. The appropriate deduction usually represents between 6 and 7 per cent of the total for Great Britain (excluding the North of Scotland) and it would be safe to say that within the accuracy attempted in these representations no difference in the characteristics described would have been observable had the whole of Great Britain been plotted.

Lord Citrine

WHEN, in July, 1947, it was announced that the Minister of Fuel and Power had appointed Lord Citrine as chairman of the projected British Electricity Authority there were many in the electricity supply industry who were doubtful about the appointment. They did not consider it a good thing that the first chairman of the nationalised industry should have been brought in from outside; they thought that an intimate knowledge of the industry should have been the prime qualification.

The *Electrical Review* held a different opinion. We said in our issue of 18th July, 1947:—

> " No doubt there are eminent electrical men who would make admirable chairmen of the Authority, but there are also others whose technical knowledge might prove a limitation rather than an advantage. The chairman will have at his disposal the best technical advice obtainable; his job will be essentially an administrative one and his background should be of this character."

Events during the past ten years have belied any fears that may have been held at the outset. In fact, the administrative experience which Lord Citrine brought to the task has been reinforced by his amazing capacity to grasp technical problems; now he could easily qualify as a consultant in electricity supply matters—technical as well as administrative.

Record of Public Service

As is well known, Lord Citrine was not exactly unfamiliar with the industry. He was trained as an electrician in the Liverpool district, where he was born in 1887. He soon made his mark in the affairs of the Electrical Trades Union and in 1914 became secretary of the Union's Mersey District. Six years later he was appointed assistant general secretary of the E.T.U. and in 1924 went into the wider field of the Trades Union Congress as assistant secretary. Very shortly afterwards he became general secretary, a position which he held for twenty years, his services in this and other spheres being recognised by his being made a K.B.E. in 1935 and a Privy Councillor in 1940. For the greater part of this period (1928-1945) he was also president of the International Federation of Trade Unions.

In 1946 he left the T.U.C. to become a member of the National Coal Board; in the same year he was created a peer under the style of Baron Citrine of Wembley. Then, as we say above, he was appointed chairman of the British Electricity Authority.

In the course of his career the services of Lord Citrine have been sought by successive Governments in a variety of subjects. He has been a member of the following bodies among others:—The National Production Advisory Council, the Reconstruction Joint Advisory Council, the Imperial Relations Trust, the Royal Commission on the West Indies (1938), the Treasury Consultative Council, the Nuffield Trust for the Forces, the Production Committee on Regional Boards (Munitions) (chairman), the Executive Committee of the Red Cross and St. John War Organisation and the Cinematograph Films Council. He is a past-president of the British Electrical Power Convention, the British Electrical Development Association, the Electrical Research Association and UNIPEDE.

Lord Citrine has written several books including the classic " A.B.C. of Chairmanship," " The Trade Union Movement of Great Britain," " British Trade Unions," " Labour and the Community " and accounts of visits to Russia, Finland and the United States.

Insistence on Adequate Plant

Lord Citrine's tenure of the chairmanship of the B.E.A. began at a difficult time in the history of the industry. Although everybody was clamouring for electricity the effects of wartime and post-war restrictions were manifest in a severe shortage of generating plant. This inadequacy might have continued had not Lord Citrine insisted and persisted with the Government that more electrical plant was vital. Now, once again, the brake has been applied, but still the Central Electricity Authority is able to hand over to the new Central Electricity Generating Board sufficient plant to avoid the restrictions which had to be imposed in earlier years.

The new Electricity Council will have the benefit of Lord Citrine's experience and advice for he is a part-time member, thus continuing his connection with the industry, which has gained so much from his work during the past ten years.

The portrait of Lord Citrine is reproduced from a colour study by Adolf Morath specially made for the Electrical Review

Citrine

ELECTRICITY SUPPLY REORGANISATION

ON 1st JANUARY the Electricity Council and the Central Electricity Generating Board began operations and thus the general control of the electricity supply industry passes from the Central Electricity Authority to the new bodies while the Area Boards secure greater autonomy. The C.E.G.B. is to operate through five Regional Executive Committees, with directors (retaining the existing Divisions), and three Engineering Project Offices.

We give below a summary of the principal features of the Electricity Act, 1957, by which these changes have been made.

WHAT THE ACT DOES

Dissolves the Central Electricity Authority and establishes a Central Electricity Generating Board and an Electricity Council.

Permits generation by Area Boards, if considered expedient, with approval of the Minister of Power.

Enables the Electricity Council, Central Electricity Generating Board and Area Boards to borrow and to raise money by the issue of stock. Authorises the Treasury to guarantee stock and temporary loans.

Empowers the Electricity Council to establish and maintain a central guarantee fund for the purpose of enabling the Council or Boards to discharge their obligations in the event of their being themselves temporarily unable to do so; and for repaying to the Treasury any payments made by it in fulfilling a guarantee.

The 1957 Act Comes into Operation

Directs the Generating Board and Area Boards to establish and maintain reserve funds.

Provides for the Generating Board and Area Boards to contribute to the expenses of the Electricity Council.

Specifies the method of transferring the Central Electricity Authority's assets and liabilities to the Electricity Council and Generating Board.

Provides for compensation to be paid to members and officers of the C.E.A. who are adversely affected.

Stipulates the method of providing traction supplies to the railways by the Generating Board and the two Scottish Electricity Boards.

Enables the English and Scottish Electricity Boards to prescribe maximum charges for the re-sale of electricity provided by them.

Deals with the testing and certification of electricity meters.

Specifies procedure in the obtaining of consents for the construction and extension of power stations; the erection of lines; and entry on land by the Boards for the purposes of exploration.

CENTRAL ELECTRICITY GENERATING BOARD. Front row, left to right:—Sir Leslie Nicholls, K.C.M.G., C.B., C.B.E., M.I.E.E. (Part-time); Mr. C. R. King, C.B.E., Comp.I.E.E., M.Inst.F. (Deputy Chairman); Sir Christopher Hinton, K.B.E., F.R.S. (Chairman); Sir Charles Geddes, C.B.E. (Part-time); Sir William Holford, F.R.I.B.A., M.T.P.I. (Part-time). Back row, Mr. E. J. Turner (Secretary); Mr. G. A. S. Nairn, M.B.E., F.R.S.A. (Part-time); Mr. F. H. S. Brown, B.Sc.(Hons.), M.I.Mech.E., M.I.E.E.; Mr. Ernest Long, F.S.A.A., F.I.M.T.A., F.C.I.S. and Mr. A. R. Cooper, M.Eng., M.I.E.E., M.Inst.F., M.R.I. In addition, Mr. Leonard Rotherham has been appointed a full-time member as from 1st April (see "Personal and Social")

THE ELECTRICITY COUNCIL

(1) Mr. J. Mould, (2) Mr. H. D. B. Wood, (3) Mr. A. N. Irens, (4) Mr. R. R. B. Brown, (5) Mr. N. Elliott, (6) Mr. D. B. Irving

(7) Lord Citrine, (8) Sir Josiah Eccles, (9) Sir Henry Self, (10) Mr. R. A. Finn, (11) Professor R. S. Edwards, (12) Mr. C. T. Melling

(13) Mr. W. S. Lewis, (14) Mr. W. A. Gallon, (15) Mr. D. H. Kendon, (16) Mr. D. Bellamy, (17) Mr. T. M. Ayres, (18) Mr. T. E. Daniel

(19) Mr. D. G. Dodds, (20) Mr. A. M. Scott, (21) Mr. C. R. King, (22) Sir Christopher Hinton, (23) Mr. E. Long, (24) Mr. W. B. Noddings

MODERN SYSTEMS FOR LARGE TURBO-ALTERNATORS

ALTERNATOR VENTILATION

By V. EASTON, B.Sc., A.M.I.E.E.*

THE impressive increase in the output of single-shaft turbo-alternators running at 3,000 r.p.m. from 60 MW in 1949 to the 275 MW units which are at present under consideration, has been dictated primarily by economic factors, but technically it has only been made possible by improvements in ventilation. The more important modification concerns the rotor since the ability to supply greater excitation power to a given mass of copper in the windings for the same or lower temperature rise permits the specific loadings of the whole of the machine to be increased and it can be redesigned to give a higher output. More effective stator cooling on the other hand only affects the physical size of the stator itself and, since it must introduce additional complication or equipment, in general it can only be justified for the largest units where transport weight becomes of over-riding importance.

Conventional Hydrogen Cooling

Shortly after the war large numbers of 60 MW hydrogen-cooled alternators were ordered by the British (now Central) Electricity Authority to operate at a gas pressure of 0·5 p.s.i.g. and this specification is typical of the many units of this size which have been commissioned in the years since 1949. In general, the ventilation scheme does not differ greatly from the usual arrangement for air-cooled machines, the chief modification being the incorporation of the gas coolers within the stator casing instead of in the foundation block and the use of fans mounted on the rotor in place of separate motor-driven fans to circulate the hydrogen. The better heat transfer properties and lower density of hydrogen result in more efficient heat dissipation and allow an increase in output compared with the equivalent rating for operation in air. A further increase in output has been obtained in machines of later design by raising the gas pressure within the casing, but the gain which is possible by this means is limited since the heat dissipation does not increase *pro rata* with the gas pressure. This is due to the fact that the heat generated in the windings must flow to the cooling medium through insulation and steel, and the temperature gradients which must be established across these parts are unaffected by gas pressure. As a result these gradients quickly become the major factor in the temperature rise and the maximum output of conventionally cooled 50 c/s alternators with present materials is of the order of 125/150 MW.

Direct Cooling

The limitation in heat dissipation due to transfer through solid matter can be eliminated if the cooling medium is arranged to flow in direct contact with the part in which the loss is generated. The temperature rise of the windings will then depend only on that of the gas and on the heat transfer drop at the duct surface. Both these factors are affected by the mass flow, so that progressively greater heat dissipation can be achieved as the pressure is increased since the volume of gas circulating remains constant. The principle can be applied to cool both stator and rotor windings and since the latter is the more important it will be considered first.

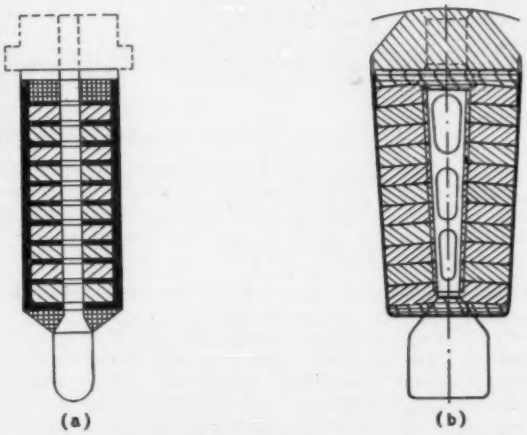


Fig. 1.—Rotor slots with radial gas flow. (a) Typical arrangement used by several British manufacturers. (b) Oerlikon

Rotor

In the last few years many articles have been published dealing either with the theoretical aspect of rotor direct cooling or describing particular constructional arrangements and it is now quite clear that it has been adopted by all the major turbo-alternator makers as the most satisfactory method to achieve more effective heat dissipation from large rotors. For example, a review of methods recently prepared by the writer included data relating to thirteen manufacturers with about two dozen references dealing with constructional features alone. It is here only possible to describe the more interesting and typical designs separated broadly into two classes having radial and axial gas flow paths respectively.

Radial Gas Flow

In this arrangement sub-slots are milled under the main winding slots and the cold gas entering from both ends of the machine passes radially outwards across the edges of the conductors and through apertures in the wedges spaced uniformly along the whole length of the rotor. The conductors are of rectangular strip form and two alternative arrangements are shown in Fig. 1. At (*a*) the strips extend across the full slot width and the gas passes through elongated slots arranged in the copper and insulation to match the holes in the wedges. At (*b*) the strips are split into two stacks, electrically connected in parallel and held apart by suitably shaped insulation blocks.

The flow of gas is induced by the pressure difference between the top and bottom of the slot generated by rotation of the shaft and the maximum volume is restricted to a great extent by the size of sub-slot which it is possible to arrange in the somewhat confined space between the bottom of the slots and the shaft diameter adjacent to the rotor body. The radial depth available for copper in

* General Electric Co., Ltd., Witton Engineering Works.

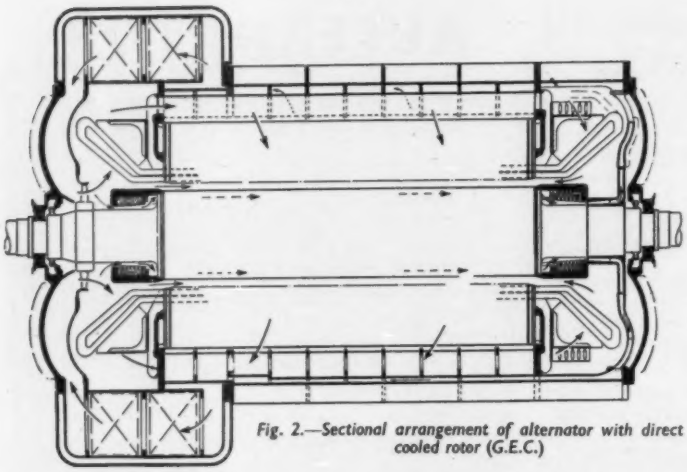


Fig. 2.—Sectional arrangement of alternator with direct cooled rotor (G.E.C.)

the winding slots is also reduced by the necessity to provide adequate leakage surface at the points of gas entry and exit, the usual arrangement being to fit thick pads of insulation at the top and bottom of the winding. Despite these limitations, which raise some doubts whether the arrangement will prove adequate for the larger units, it is a simple scheme to adapt to a conventional rotor and is used by several makers in this country and on the Continent.

Axial Gas Flow

There is a much greater variety of arrangements employing axial gas flow in the rotor; it is more widely used and in general it lends itself to a greater degree to the exploitation of the advantages of direct cooling. The gas circuit may be from one end of the rotor to the other to maintain normal insulation leakage surfaces or it may be divided into several parallel paths with cold gas entering at both ends of the rotor, or at intermediate points from sub-slots, with the discharge into the gap through the wedges in one or more localised positions.

In two designs the gas is both picked up from, and returned to, the gap in different axial positions by means of suitably shaped and inclined channels leading from the rotor surface to the side of the winding slots, the gas passing axially along the conductors between the inlet and outlet channels.

The advantage of parallel gas circuits is the reduction in head required to circulate the hydrogen, in some designs to such a value that the natural rotational head is sufficient. The disadvantages include the necessity to provide adequate leakage surface at the ports for gas discharge (and inlet from sub-slots) and the heating of the stator by the gas exhausting from the rotor. With end-to-end ventilation a high head impeller is required but this can readily be provided and arranged to exhaust direct into the coolers. The stator temperature rise is then unaffected by the excitation power, an important point since with direct cooling the permissible gas rise is appreciably higher than in a normal machine. A sectional arrangement through one machine embodying this principle is shown in Fig. 2.

The axial gas passages may be arranged in several ways, the flow being either within hollow conductors or in recesses formed between shaped strips and the inside of the main insulation tube. The best type of hollow conductor is a solid drawn tube, Fig. 3a, and these can now be produced in the required square or rectangular section to close tolerance by several firms in this country. The arrangement of side-by-side conductors shown in this sketch is designed to obtain a good aerodynamic section of duct without reducing the number of conductors in a slot. Hollow conductors of lower mechanical rigidity can also be built up by inverting one channel section on top of another, Fig. 3b, and connecting the two electrically in parallel so that no insulation is required between the narrow limbs.

Examples of slots using strip conductors are shown in Figs. 3c and 3d, the former having turns of uniform section throughout the slot whereas the conductors of the latter are all of different shape. This obviously requires a considerable amount of preparatory machining before the coils are wound, a comment which also applies to slot 3b. In general, the hollow conductor provides a large surface in contact with the hydrogen with a corresponding small temperature drop from copper to gas and

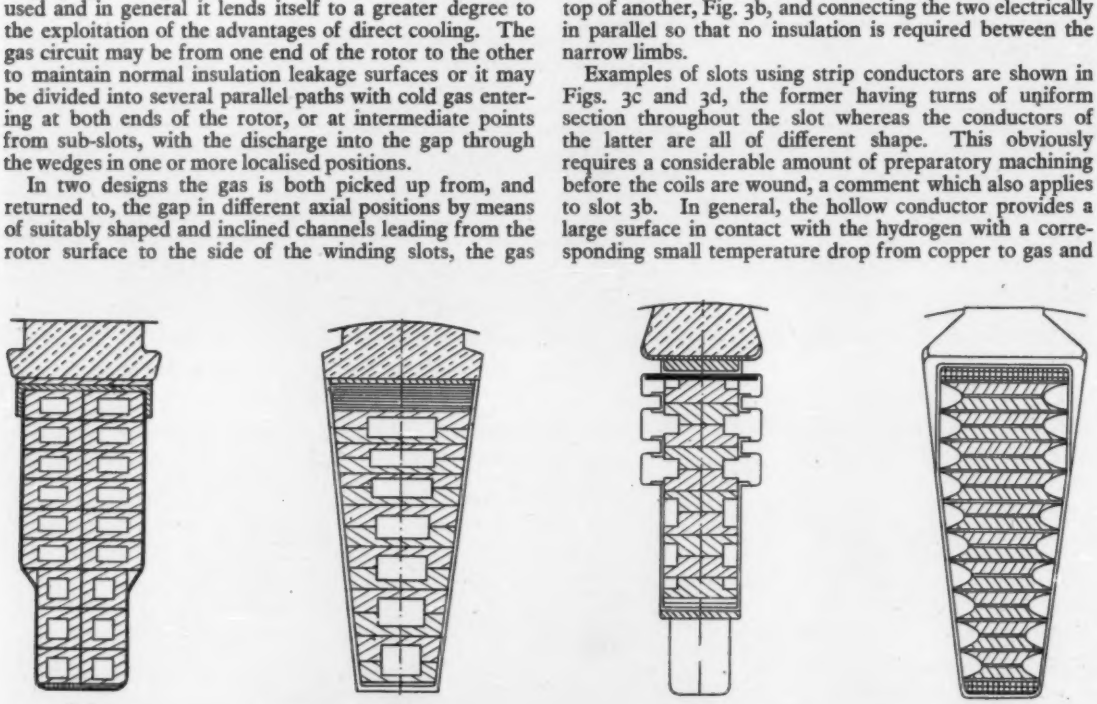


Fig. 3.—Rotor slots for axial gas flow. (a) G.E.C. (b) Westinghouse. (c) Brown Boveri. (d) Allis Chalmers

by concentrating the section for gas flow in one channel it gives the lowest pressure drop per unit length of conductor.

Stator

In principle a conventionally cooled stator could be built for outputs in excess of the maximum now under consideration if it were not for the limitation imposed by transport weight and size. This difficulty could be overcome by building the core and winding on site and if necessary jacking the completed stator into position, but all manufacturers wish to avoid this procedure if at all possible. A direct cooled stator winding is of assistance in this respect as the designer is free to select the most suitable dimensions for the slot without considering the heat dissipation surface of the insulation and so can use one of a wide shallow shape with corresponding reduction in overall core diameter and weight.

At present gas is used exclusively as the cooling medium in turbo-alternator rotors owing to the problems of balance and hydraulic stressing which would arise if a liquid was circulated through the windings. There is no such difficulty on the stator and the designer has in practice a choice between water, transformer oil and hydrogen. Liquids have a much greater thermal capacity than hydrogen, hence for a given loss a lower weight of coolant is required and a smaller proportion of space within the main insulation is occupied by the ducts. Water is preferable to oil since it eliminates the fire hazard while its higher specific heat and lower viscosity reduce the pressure drop in the ducts and therefore the pumping losses to a negligible percentage of the alternator output. It is less satisfactory as an insulator, which is the great advantage of transformer oil, but turbine condensate provides a source of liquid of higher resistance than commercial distilled water and there is no difficulty in limiting the leakage currents to reasonable values. Hydrogen, on the other hand, has the advantage of simplicity of ventilation arrangement but introduces problems in the insulation of the windings at the points of gas entry and discharge and may be found to require an excessive duct area for alternators of the largest outputs.

Another important point in the design of stator conductors is the limitation of the stray loss resulting from the non-uniform current density in the copper. This non-uniformity is due to the transverse flux across the slot generated by the alternating current in the conductors themselves, the flux being zero at the bottom of the slot and increasing to the maximum at the surface of the copper adjacent to the bore. Since it can be shown that the stray loss is proportional to the fourth power of the depth of conductor, the latter should be the minimum, and it is for this reason that conductors of a conventional winding generally consist of a number of relatively thin insulated copper strips connected in parallel. When the total depth of a conductor is small this sub-division may be all that is required, but on large alternators where there are only two deep conductors per slot it is necessary in addition to transpose the individual strips, i.e. to alter their relative positions in the slots in a cyclic and orderly way.

In general, this may be accomplished in two ways: first, the strips may be transposed when making the joints between coils, the interstrip insulation being continuous throughout the winding and the transposition cycle being completed in this length. Secondly, the strips may be divided into two stacks side by side and "twisted" in the length of the core in a similar manner to a single layer cable to produce a "Roebel" bar. It must be appreciated, however, that any method of transposition will have no effect on part of the stray loss, which is determined primarily by the depth of the individual lamination and for a balanced design the latter should be limited to a figure equivalent to, say, 0·1in.

Liquid Cooling

Details of several arrangements for liquid-cooled stator conductors have been published in the technical press. One American design has conductors consisting of two stacks of rectangular tubes as shown in Fig. 4a, twisted together to form a Roebel bar with all tubes brazed solidly into a common header at both ends of each conductor bar. Transformer oil is used as the coolant with the flow in parallel through all the stator coils, the common supply and drain oil pipes being situated at one end of the stator. The connections to the headers are made by flexible metallic pipes which lead the oil from the coil ends through ceramic insulators to the main oil pipes so isolating the windings from earth. It is stated that this arrangement could be simplified by using connectors of insulation material in place of the metallic pipes and solid insulators and that suitable materials are available. At one end of the stator the joints can be insulated in the normal way, but at the other the two oil connections to each joint require special insulation. The number of flexible pipes required is twice the number of slots, i.e. of the order of 100. From the test results which have been published a comparison of the oil temperature rise in the top and bottom conductors indicates that even with this relatively small section of tube the eddy current loss is appreciably higher than normal.

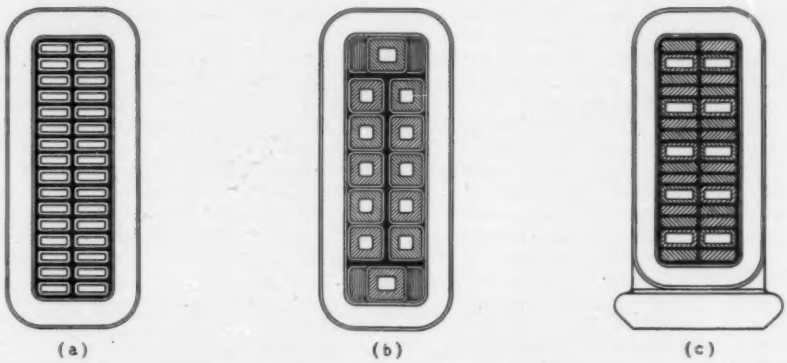


Fig. 4.—Liquid cooled stator slots. (a) G.E. of America. (b) M.V. (c) G.E.C.

Condensate in a closed circuit is used as the cooling medium in two British designs, but apart from this the arrangements are quite different. The first is in principle similar to that just described in so far as a Roebel type bar is used with each conductor header connected to the supply or drain water mains. The latter are placed at opposite ends of the stator casing so that the flow is from one end of a conductor to the other; this doubles the number of flexible pipes required and as they are of

plastic material they represent a potential source of water leakage on to the windings. The conductors, Fig. 4b, are again tubular in form, but fewer in number than the previous design. A square section is used and although transposed in the slots, the dimensions suggest that again a high eddy current loss would be expected. The potential difference between the various parts of the stator winding and earth is absorbed in the resistance of the water columns contained in the plastic pipes and no difficulty should be experienced in limiting the leakage current to a low value. The scheme has been applied to the stator windings of a 30 MW air-cooled alternator, presumably to obtain operating experience as quickly as possible, and the quoted copper temperature rise on test is unrealistically low.

The second design has been developed on the basis of minimum disturbance to accepted practices and the use of well-established components exclusively within the stator casing while, at the same time, the total copper loss has been kept to a low figure by the use of the conductor shown in Fig. 4c. This consists of a number of copper tubes spaced symmetrically within the main insulation, each associated with two copper strips placed above and below it with light insulation interposed so that the temperature difference between strip and tube is negligible. The strips are arranged in two stacks for convenience of manufacture and to reduce slightly the stray loss and they are laid flat throughout the winding without any twisting, all transposition being effected in a very simple manner when making the joints between adjacent coil ends. With this combination of strips and tubes the greater part of the current is carried by the most efficient conductors, i.e. the strips; hence the walls of the tubes need not be thick and the eddy current loss is little if any greater than that of a comparable conventionally cooled conductor. Furthermore, the concentration of water flow into a few relatively large channels improves the hydraulic efficiency and reduces the pressure drop to such an extent that several coils can be connected in series between the supply and drain water mains. It is possible on a large machine to supply cold water through the six terminal bushings and discharge it at the mid-point of each phase, so reducing to three the number of tapping points at different electrical potential. It is then practicable to use insulated metal pipes with brazed joints for all water connections within the stator casing, and to limit the leakage current to earth by means of water resistance columns placed in any convenient position in the foundation block. The absence of any abnormal insulation material or techniques and the simple layout of the water system ensures reliability.

Gas Cooling

Two American firms have built alternators with direct cooled stator conductors using hydrogen as the coolant with the flow from one end of the conductors to the other through a centre duct between two stacks of solid copper strips, Fig. 5. This is the only practicable arrangement as it reduces to the minimum the pressure head required, but even so there may be difficulty in the largest alternators in obtaining sufficient mass flow without excessive duct area with consequent sacrifice of copper section. The strips are transposed in any of the usual ways to reduce stray loss and for the same reason the centre duct is composed of a number of separate thin-walled tubes preferably of high resistance material. The tube walls and the insulation between them and the strips will reduce the useful space factor in the slots while the necessity to transfer the heat loss through the edge of the strips and this insulation to the tubes must result in a greater temperature difference between copper and coolant than if a liquid is used. The ends of the tubes forming the centre channel are shielded in one design by means of silicone rubber sleeves. As previously mentioned, the chief advantage of gas cooling is the absence of any additional equipment compared with a conventional alternator.

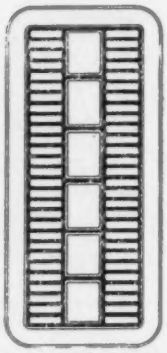


Fig. 5.—Typical gas cooled stator slot. (Allis Chalmers and Westinghouse)

Conclusions

Direct cooling by hydrogen is already accepted as standard practice for the rotor windings of turbo-alternators. Since it reduces the size of the whole machine it may be applied with advantage to relatively small units and further advances are possible if the mass flow of gas is increased. The benefits derived from directly cooling the stator windings become important only when weight restriction is the deciding factor and therefore it is unlikely to be applied to machines of similar low output.

In this country there is no doubt that steam turbine condensate is favoured as a coolant for stator windings in preference to transformer oil. The problem facing the designer is one of providing the simplest and most efficient cooling system without departing too much from established methods of winding which have proved their reliability over many years. The brief outline of the various designs which have been developed indicates the progress which has been made in this direction.

BIBLIOGRAPHY

Easton V. Direct Rotor Cooling. *Electrical Energy*, Oct.-Nov. 1956.

Manufacture of Large Turbo-Alternators. *Bulletin Oerlikon* (1955).

Direct Cooled Turbo-Alternators. *Electrical Review*, 27th May, 1955.

Baudry R. A., Heller P. R. Ventilation of Inner Cooled Generators. Power Apparatus and Systems, No. 12 (1954).

Beckwith S., Rosenberg L. T. A new Fully Supercharged Generator. *Power Apparatus and Systems*, No. 12, 477 (1954).

Weidemann E. The Hydrogen Cooling of Turbo-Generators. *Brown Boveri Rev.* 41,79,93 (1954).

Easton V. The Design of Large Turbo-Alternators. *G.E.C. J.*22,155 (1955).

Kilbourne C. E., Holley C. H. Liquid Cooling of Turbine Generator Armature Windings. *Power Apparatus and Systems*, No. 25, 1956.

Water Cooled Alternator Windings. *Electrical Review*, 14th Dec., 1956.

Direct Cooled Stator Windings. *Electrical Review*, 7th June, 1957.

Titov V. V., Kogan Z. B. A Turbo-Generator Rotor with Directly Cooled Winding Conductors. *Elektrichestvo*, 1957, No. 6.

European Nuclear Energy Agency

THE Council of the Organisation for European Economic Co-operation has adopted the statute of the European Nuclear Energy Agency and signed a convention on security control. At the same time twelve member countries of the Organisation have signed the international agreement setting up a first joint undertaking, the European Company for the Chemical Processing of Irradiated Fuel (Eurochemic).

The Agency is to be instituted on 1st February. Its objects are to further the development of the production and use of nuclear energy for peaceful purposes through technical co-operation among the countries of Western Europe. It will promote the establishment of joint undertakings between those countries, discuss their research and production programmes for nuclear energy, study their requirements for raw materials and capital equipment, promote the liberalisation of trade in these products, develop facilities for the training of specialists and help to frame national legislation, in particular as regards the safeguarding of public health, prevention of accidents, third-party liability and atomic risk assurance. The United Kingdom is not a member of the Agency.

OVERSEAS ELECTRICAL TRADE

ADVANCE IN NOVEMBER EXPORTS OF HEAVY ENGINEERING PLANT

BRITISH electrical exports in November showed a welcome advance on the figures for the preceding month, but they were still below the total for November, 1956. Taking the eleven months as a whole, however, the total was nearly £9 million better than for the corresponding period of 1956. The total value of exports in November last was £19,394,057, as compared with £17,753,437 for October, and £20,041,484 for November, 1956. Advances were shown in the heavy electrical engineering sections, as compared with November, 1956, but the electric cables and wires and the radio equipment groups showed decreases.

In the generators, generating sets, motors, etc., group the value of exports was £3,203,086, as compared with £2,800,705 in October, and £2,825,619 for November, 1956. Exports of converting machinery, mercury-arc rectifiers, transformers, switchgear, etc., were £2,742,049, as against £2,195,583 in October and £2,537,653 in November, 1956.

In the radio equipment section, exports at £2,721,694

TABLE I.—ELECTRICAL EXPORTS

Class	November, 1957	Eleven months ended 30th November, 1956	Eleven months ended 30th November, 1957
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	144,681	1,581,389	1,589,650
Ditto, 10 to 65 kW	192,175	1,703,627	1,872,427
Ditto, 65 to 200 kW	121,005	1,389,622	1,278,934
Ditto, over 200 kW	225,865	3,233,287	3,503,515
Spark ignition engine driven	35,744	305,678	204,370
Steam turbine driven	89,988	1,141,637	784,787
Hydraulic turbine driven	89,463	55,114	168,630
Other prime mover driven	7,365	529,254	249,345
Generators, not exceeding 200 kW	201,810	1,338,746	1,767,882
Ditto, over 200 kW	87,437	934,470	1,461,696
Parts of generators	684,820	5,262,241	4,296,742
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p.	214,962	2,140,967	2,173,396
Over ½ but under 1 h.p.	61,917	595,559	555,420
1 h.p. to 250 h.p.	503,482	4,712,238	5,221,342
Over 250 h.p.	122,081	765,201	1,457,945
Railway, tramway and trolley-bus motors complete and parts of all motors	169,886	1,809,964	2,182,144
Motor starting and controlling gear	250,405	2,753,489	3,541,480
	3,203,086	30,252,483	32,309,755
Converting machinery	20,169	335,247	469,363
Mercury-arc rectifiers	153,574	896,776	1,392,203
Transformers for lighting, heating and power (incl. coils):			
Not exceeding 7,500 kVA	607,944	11,119,216	6,430,359
Over 7,500 kVA	341,364		3,193,353
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	462,869	3,196,934	4,098,997
Ditto, other	1,156,129	12,438,016	12,797,576
	2,742,049	27,986,189	28,381,851
Primary batteries:			
Lighting	85,524	924,273	1,077,742
Radio	299,723	2,870,503	2,739,350
Other	40,783	471,706	439,481
Parts (excl. carbons)	56,077	441,517	619,899
Lamps:			
Filament, exceeding 28 V*	102,257	1,077,784	1,002,699
Ditto, under 28 V*	35,430	344,290	324,017
Arc lamps and searchlights	6,230	211,183	128,734
Discharge lamps, fluorescent tubes, etc.	97,929	805,466	1,033,424
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury arc rectifiers), photo-electric cells, stabilising and cold cathode valves, magnetrons, klystrons	15,363	273,697	232,395
All other	261,318	2,826,842	3,205,166
Parts (excluding glass bulbs)	19,705	114,072	154,581
Radio and television transmitters	58,820	987,476	660,361
Commercial radio and radar equipment	1,006,249	14,287,071	13,962,775
Domestic radio receivers, mains	109,185	1,483,697	1,189,348
Ditto, battery	51,676	812,458	606,107
Ditto, other (incl. car)	35,840	279,252	307,743
Radiograms	51,403	389,658	372,956
Television sets	158,343	571,610	714,874
Public address equipment	90,219	925,682	1,010,448
Other radio and television apparatus, n.e.s.	21,020	398,263	428,257
Components and parts, n.e.s.	842,553	7,742,741	8,786,982
	2,721,694	31,092,519	31,632,493
Telegraph and telephone installations	800,678	6,817,928	8,107,268
Telephone instruments, separately consigned	201,765	1,596,569	1,692,898
Telegraph and telephone parts	841,362	7,147,141	8,731,427
Line apparatus for long distance communication	201,632	2,437,857	2,231,152
	2,045,437	17,999,495	20,762,745

Class	November, 1957	Eleven months ended 30th November, 1956	Eleven months ended 30th November, 1957
	£	£	£
Cookers	59,195	850,860	705,019
Toasters	62,250	356,620	281,609
Other cooking apparatus	37,381	402,818	368,725
Parts and accessories	68,676	855,043	719,250
Space heating appliances	52,189	389,795	406,110
Water heating appliances	26,104	358,066	345,652
Other heating appliances	28,704	387,942	357,573
Parts and accessories	71,066	701,056	628,129
Irons	105,365	1,053,534	883,483
Arc welding equipment, a.c.	42,600	574,228	540,877
Ditto, d.c.	63,713	535,042	514,419
Resistance welding equipment	15,656	184,904	240,970
Electric furnace plant	92,844	648,062	847,513
Magnetos, ignition	22,546	312,055	248,481
Sparking plugs	152,216	1,918,938	1,777,429
Elec. appliances for aeroplanes, n.e.s.	328,320	2,385,461	3,019,421
Ditto, for motor vehicles, n.e.s.	395,950	3,967,915	3,805,742
Ditto, for cycles, n.e.s.	53,460	649,607	602,980
Signalling app. (incl. traffic signals)	125,404	772,137	1,332,215
Instruments, commercial	143,512	1,902,602	1,810,417
House service meters (including parts)	163,082	1,862,063	1,598,554
Electro-medical apparatus (not X-ray)	41,041	456,679	417,666
X-ray apparatus (excl. tubes and valves)	82,194	701,499	804,840
Vacuum tubes	43,267	324,242	454,589
Ceiling fans, complete	84,234	1,129,861	1,136,666
Desk fans, complete and parts of desk and ceiling fans	27,045	438,719	434,361
Vacuum cleaners	171,903	1,574,751	1,643,327
Floor polishers	97,102	838,399	962,471
Food mixers	78,002	655,362	607,084
Hair clippers and dry shavers	98,253	877,412	795,383
Other portable appliances	22,173	319,304	285,145
Parts	111,258	1,265,767	1,462,435
Portable elec. tools (not saws) and parts	209,159	2,420,501	2,372,430
Cables and wires:			
Telegraph and telephone, submarine	9,527	1,936,482	4,251,800
Ditto, other	943,378	9,308,319	10,303,123
Cotton, silk or art. silk insulated	24,775	540,696	383,607
Enamel, glass or asbestos insulated	67,076	1,132,677	982,105
Paper insulated	581,768	9,931,155	8,159,746
Rubber insulated	542,995	5,943,182	5,888,335
Thermoplastic insulated	237,165	1,611,651	2,142,458
Other	212,347	2,384,704	1,938,467
	2,619,031	32,788,866	34,049,641
Accumulators for motor vehicles	141,889	1,677,311	1,669,262
Ditto, traction	18,741	336,677	289,364
Ditto, radio and other portable	29,230	962,022	657,883
Ditto, other	11,498	716,966	325,867
Parts and accessories	89,946	1,066,598	916,252
Elec. porcelain, etc. (incl. insulators), n.e.s.	91,299	1,241,614	1,094,910
Insulating cloth and tape	54,524	676,197	608,974
Other insulating material	103,005	1,088,090	1,053,642
Permanent magnets	63,744	516,047	585,703
Radio, telegraph and telephone testing equip., n.e.s.	78,140	458,245	722,079
Scientific elec. instruments (not telegraphic or telephonic):			
Time recorders and time switches, complete	13,772	157,941	138,458
Other	364,796	2,442,084	3,395,888
Electrical machinery, n.e.s.	77,800	1,210,355	1,007,083
Electrical apparatus and appliances, n.e.s.	1,024,559	8,916,185	10,045,804
TOTAL	19,394,057	200,803,850	209,423,965

* The figures for 1957 are not completely comparable with those for previous years.

TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	November, 1957	Eleven months ended 30th November, 1956	Eleven months ended 30th November, 1957
	£	£	£
Channel Islands	143,972	911,638	1,075,259
Gibraltar	19,250	397,865	226,427
Malta and Gozo	82,858	774,759	696,668
Cyprus	103,667	1,474,386	1,396,305
Sierra Leone	25,927	272,018	385,320
Gold Coast	83,859	1,513,640	1,713,152
Nigeria	320,564	3,141,609	3,065,338
Union of South Africa	1,802,373	14,432,444	16,490,204
Rhodesia and Nyasaland	613,082	5,469,779	5,562,829
Tanganyika	59,003	629,948	784,292
Kenya	176,575	2,670,638	2,438,523
Uganda	83,310	807,991	905,612
Mauritius	24,627	273,321	370,079
Aden	34,007	515,792	478,821
Bahrain, Qatar and Trucial States	130,905	937,216	1,505,025
Kuwait	316,906	1,550,221	2,979,336
India	1,495,695	19,688,030	20,524,706
Pakistan	219,664	3,381,360	2,746,953
Singapore	448,475	3,595,456	3,782,991
Federation of Malaya	253,479	3,002,857	3,018,965
Ceylon	151,765	2,099,540	1,620,904
British North Borneo	23,189	248,585	264,820
Sarawak	20,350	175,244	231,966
Hong Kong	267,150	2,571,654	2,744,859
Australia	1,776,756	20,064,903	18,868,947
New Zealand	1,082,182	9,816,020	10,741,212
Fiji	11,000	233,475	179,710
Canada	1,053,946	12,137,933	11,888,402
Jamaica	130,365	1,062,872	1,224,982
Barbados	23,153	254,622	195,324
Trinidad	91,898	1,079,503	1,212,087
British Guiana	42,317	427,254	467,841
Other Commonwealth countries	148,313	1,033,609	1,312,027
Irish Republic	313,853	3,137,642	2,562,250
Soviet Union	62,209	2,320,127	1,963,329
Finland	140,765	1,767,907	1,517,629
Sweden	488,802	3,997,727	4,485,593
Norway	377,065	2,494,258	2,575,773
Iceland	2,036	160,044	160,262
Denmark	245,092	2,078,574	2,080,491
Poland	171,022	284,649	694,443
Western Germany	272,535	2,008,226	2,365,134
Netherlands	531,846	7,558,461	7,188,073
Belgium	280,343	3,086,570	3,351,725
France	175,310	3,921,299	3,721,688
Switzerland	139,750	1,122,915	1,359,464
Portugal	262,351	1,976,406	3,009,013
Spain	202,541	4,476,827	3,538,577
Italy	388,625	3,087,964	3,679,991
Austria	27,107	438,264	429,932
Yugoslavia	133,552	498,480	664,544
Greece	87,374	2,323,077	1,291,650
Turkey	117,089	745,573	855,962
Belgian Congo	80,667	324,647	536,909
Portuguese East Africa	32,474	244,724	306,337
Egypt	35,536	1,722,743	169,138
Libya	46,657	298,879	429,562
Southern Morocco	58,250	510,003	405,523
Sudan	56,961	811,030	1,077,221
Syria	21,157	723,982	292,892
Lebanon	48,028	622,335	481,676
Israel	69,538	973,121	654,571
Jordan	38,117	537,774	532,132
Saudi Arabia	36,199	1,354,551	505,130
Iraq	254,872	3,089,781	2,641,591
Iran	292,927	2,052,512	3,852,522
Burma	115,314	1,192,622	1,094,543
Thailand	51,544	981,603	921,556
Indonesia	27,418	570,782	506,961
Japan	53,639	703,735	768,572
United States of America	739,049	8,496,132	12,065,881
Cuba	84,657	402,605	715,507
Mexico	81,556	749,039	625,443
Colombia	114,545	892,097	671,795
Venezuela	340,814	2,873,849	3,317,373
Peru	46,364	674,024	608,693
Chile	149,748	389,495	574,656
Brazil	191,147	1,626,804	1,207,065
Uruguay	20,501	110,319	246,007
Argentine Republic	203,308	847,792	1,525,093
Other foreign countries	423,221	2,895,698	4,094,207
TOTAL	19,394,057	200,803,850	209,423,965

showed a fall of about £300,000 as compared with the preceding month, and of about £600,000 when compared with November, 1956. Telegraph and telephone equipment exports were up by about £300,000 as compared with October, and were slightly better than the total for November in the preceding year. While the cables and wires group showed an improvement of about £250,000 over the October figure, the total was still £700,000 less than for November, 1956.

The principal markets for generating plant in November continued to be Australia (£396,770), South Africa (£384,902) and India (£364,439).

Italy jumped into first place in the radio equipment group with purchases valued at £234,703. Canada, with a total of £161,663, was second, and third place was held by the Netherlands with £148,505. Australia was easily the best market for telegraph and telephone material, taking equipment valued at £385,213. The best market for cables and wires was New Zealand whose purchases were valued at £324,402. India was the next best customer, importing material valued at £236,649. Outside the Commonwealth, the United States made purchases of £195,677.

The electrical exports are analysed in Table I and their destinations are shown in Table II. Other electrical equipment shown in the Board of Trade returns, but not shown in the electrical section, includes the following:—

Electrically operated washing machines, complete, not exceeding 150 lb net weight: November, £253,500; eleven months, £3,066,138 (against £3,305,897). Ditto, 150-250 lb: November, £104,704; eleven months, £1,066,611 (£1,130,564). Parts: November, £52,258; eleven months, £632,775 (£758,515).

Electric locomotives: November, £215,403; eleven months, £3,365,390 (£2,679,532).

Locomotives with i.c. engines and electrical transmission: November, £302,737; eleven months, £3,108,791 (£7,977,399).

Welding electrodes (excluding carbons), covered: November, £121,715; eleven months, £1,256,761 (£1,245,567).

Electric conduit tubes and cased tubes: November, £57,042; eleven months, £765,737 (£844,628).

Electric carbons (including parts): November, £53,869; eleven months, £594,346 (£537,995).

Electric lighting fittings and lanterns, complete, with or without bulbs (excluding arc lamps, searchlights, and cycle lamps): November, £218,126; eleven months, £2,258,963 (£1,625,409).

Other electric lighting appliances (excluding vacuum tubes and lamp bulbs) and fittings and parts, n.e.s.: November, £194,953; eleven months, £2,444,477 (£3,579,700).

Imports of electrical goods in November totalled £2,786,076, as compared with £2,606,091 in October and with £2,265,379 in November, 1956. For the eleven months of the year the total was £24,793,745, as compared with £21,860,625 for the corresponding period of 1956.

Mr. E. H. Ball

Mr. C. Metcalfe

Mr. R. A. McMahon

Mr. L. H. Welch

Sir Harold Yarrow

NEW YEAR HONOURS

Electrical Men in the List

THE New Year Honours List which was published on Wednesday includes a number of prominent men in the electrical and allied industries. Among them are the following to whom we extend our congratulations:—

Mr. S. J. Harley, chairman and managing director, Coventry Gauge & Tool Co., Ltd., and **Mr. A. S. Ward,** president, Thomas W. Ward, Ltd., receive knighthoods, **Mr. H. W. Melville,** secretary, Department of Scientific and Industrial Research, is created a Knight Commander of the Order of the Bath (K.C.B.), and **Mr. H. Constant,** F.R.S., director, National Gas Turbine Establishment, Ministry of Supply, becomes a Companion of the Order of the Bath (C.B.).

Sir Harold Yarrow, Bt., C.B.E., LL.D., M.I.C.E., chairman and managing director of Yarrow & Co., Ltd., has been created a Knight Grand Cross of the Order of the British Empire (G.B.E.).

C.B.E.

New Commanders of the Order of the British Empire (C.B.E.), are **Mr. E. H. Ball,** M.I.E.E., managing director of the British Thomson-Houston Co., Ltd.; **Mr. J. A. Mason,** M.I.E.E., M.I.I.A., manager and director of the Automatic Telephone & Electric Co., Ltd.; **Mr. C. Metcalfe,** A.M.I.Prod.E., managing director, E.M.I. Electronics, Ltd.; **Mr. M. J. L. Pulling,** O.B.E., M.A., M.I.E.E., Controller, Television Service Engineering, B.B.C.; **Mr. A. Barraclough,** English Electric Export & Trading Co., Ltd., New York; and **Mr. R. W. West,** Principal, Battersea College of Technology.

O.B.E.

Officers of the Order (O.B.E.), include **Mr. W. J. Challens,** senior superintendent, Weapons Electronics, Atomic Weapons Research Establishment, Aldermaston; **Lt.-Col. E. N. Elford,** T.D., manager, Radar Division, Marconi's Wireless Telegraph Co., Ltd.; **Mr. A. N. Ferrier,** C.A., chief accountant, North of Scotland Hydro-Electric Board; **Mr. H. C. Fitzer,** B.Sc.(Eng.) (Lond.), A.M.I.E.E., superintending electrical engineer, Admiralty, Bath; **Mr. R. A. McMahon,** M.I.E.E., secretary, Electrical Research Association; **Mr. E. G. Rowe,** M.Sc., A.C.G.I., D.I.C., M.I.E.E., chief valve officer, Standard Telephones & Cables, Ltd.; **Mr. W. Swift,** director and deputy general manager, Joseph Lucas Gas Turbine Equipment, Ltd.; **Mr. A. Sykes,** technical director, David Brown & Sons (Huddersfield), Ltd.; and **Mr. L. H. Welch,** B.Sc.(Eng.), M.I.E.E., chief engineer, London Electricity Board.

M.B.E.

New Members of the Order of the British Empire (M.B.E.), include **Mr. J. A. Acraman,** chief electrician, central workshops, Trent Motor Traction Co., Ltd.; **Mr. H. Annis,** chief inspector, Metropolitan-Vickers Electrical Co., Ltd.; **Mr. J. A. Barber,** contracts manager, J. & H. McLaren, Ltd.; **Mr. J. C. Garnes,** senior assistant engineer, South of Scotland Electricity Board; **Mr. W. Hardy,** electrical engineer, Admiralty Gunnery Equipment Department; **Mr. J. A. Leith,** engineer-in-charge, Westerglen Transmitting Station, B.B.C. (Falkirk); **Mr. J. K. Lightfoot,** works superintendent, English Electric Co., Ltd., Stafford; **Mr. H. Lloyd,** A.M.I.E.E., assistant chief engineer (operation and construction), Yorkshire Electricity Board; **Mr. W. H. Minnitt,** mechanical and electrical engineer, Air Ministry (Finchley); **Mr. L. W. Sharp,** assistant engineer, Telephone Manager's Office, Reading, G.P.O.; **Mr. W. R. Sutherland,** chief draughtsman, Parsons Marine Engine Turbine Research & Development Association ("Pametrada"), Research Station, Wallsend; **Mr. J. O. C. Whelans,** production engineer, Valve Making Department, Mullard Radio Valve Co., Ltd.; **Mr. V. E. Swindells,** works manager, Thermega, Ltd.; and **Mr. F. C. Wright,** assistant engineer, Telephone Manager's Office, Liverpool, G.P.O.

Power from the Rhône

The launching of a public loan of six milliard francs by the Compagnie Nationale du Rhône draws attention to the immense amount of work that has been, and is being, done to harness the hydro-electric potential of the River Rhône from the point where it crosses the Swiss frontier to the sea. When the three remaining sets in the Henri-Poincaré station are commissioned in 1958, the Compagnie Nationale du Rhône will be providing 10 per cent of the total electricity production of France.

The importance of this river is also underlined by a recent report by the Commission de l'Energie du Plan. This concludes that out of the new hydro-electric plant, equivalent to 2 milliard kWh a year, which it will be necessary to commission in France between 1957 and 1961, a fifth should be installed on the Rhône.

Work is now in progress at Baix-Le Logis-Neuf, immediately above Montélimar, and the station is planned for operation in the winter of 1960-61. In the following winter the station at Beauchastel, between l'Isère and Mondragon, which will have an annual output of 1,110 million kWh, will be commissioned. When the dam at Pierre Bénite, below Lyons, is brought into operation in 1961 to give an output of 465 million kWh, it will create a single sheet of water 21 km long. This will not only transform the conditions for navigation but will make it possible to set up a new industrial region around Lyons along the banks of the canal.

The Commission also recommends that work should be started on the station at Valence.

When the Compagnie Nationale du Rhône has completed all the work now approved, its annual output of electricity will reach 9·3 milliard kWh.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Minister of Power has appointed **Mr. Leonard Rotherham,** M.Sc., M.Inst.Met., to be a full-time member of the Central Electricity Generating Board with effect from 1st April. Mr. Rotherham is director of research and development at the Industrial Group Headquarters of the United Kingdom Atomic Energy Authority, Risley, Warrington, Lancs. He was educated at University College, London. His previous appointments include those as physicist at the Firth Brown Research Laboratories, Sheffield (1934-46), and as superintendent of the Metallurgical Department, Royal Aircraft Establishment, Ministry of Supply. In 1950 he was appointed assistant controller of the Atomic Energy Division, Ministry of Supply, and took up his present duties in 1954.

Mr. L. Rotherham

Dr. H. W. Melville, F.R.S., secretary of the Department of Scientific and Industrial Research, has succeeded **Sir Ben Lockspeiser,** K.C.B., F.R.S., as one of the Government's delegates to the Council of the European Organisation for Nuclear Research (C.E.R.N.).

Sir Ben, who has also been president of the Council of C.E.R.N., retired from the United Kingdom public service in March, 1956, and asked to be relieved of his responsibilities as a Council member. The other United Kingdom delegate to C.E.R.N. is **Sir John Cockcroft,** O.M., K.C.B., C.B.E., F.R.S.

Mr. H. C. Poore has been appointed manager of the West Kent District of the South Eastern Electricity Board in succession to Mr. P. S. Watson who, as we have already reported, becomes Brighton and Hove manager. Mr. Poore is at present commercial engineer for Croydon and Purley District. He was born in London and educated at Wandsworth County School and at two London technical institutes. He started his career with the County of London Electricity Supply Co. and had five years' experience with that company before joining the Royal Engineers in 1940. He served in the Middle East for 3¼ years and then returned to England to become officer-in-charge of administration for R.E. training. On demobilisation Mr. Poore had further training under a Governmental scheme and then spent three years with the Camberwell electricity undertaking. A year with an industrial firm followed before he joined Seeboard in 1950 as commercial engineer at Purley. In 1952 he was appointed commercial engineer for Croydon District and four years later, when Croydon and Purley Districts were merged, he became commercial engineer for the combined district.

On his doctor's advice, but not with effect until 31st October next, **Vice-Admiral J. W. S. Dorling,** C.B., M.I.E.E., is to retire from his appointment as director of the Radio Industry Council. He was the Council's first director, being appointed in 1946, immediately after the formation of the Council as the co-ordinating body of four associations in the industry. Admiral Dorling, who has been on sick leave since October, hopes to return to his duties in mid-January. No successor has yet been appointed.

Admiral Dorling is president of the Radio Industries Club. He made his first radio set more than fifty years ago and had a distinguished career as a wireless officer in the Royal Navy in the 1914-18 war and after. His last command was the *Royal Sovereign* and after being Deputy Controller of the Admiralty he went to the United States in 1941 as British Admiralty supply representative, taking over 813 U.S.-built ships on "Lend-Lease."

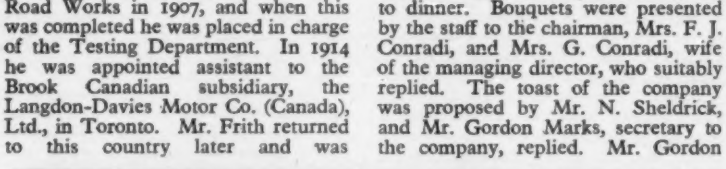
Mr. H. Frith, manager of Brook Motors Leeds sales office since 1920, retired at the end of December. His fifty years commenced as an apprentice to E. Brook, Ltd., at the Colne Road Works in 1907, and when this was completed he was placed in charge of the Testing Department. In 1914 he was appointed assistant to the Brook Canadian subsidiary, the Langdon-Davies Motor Co. (Canada), Ltd., in Toronto. Mr. Frith returned to this country later and was appointed manager of the sales office at Leeds in 1920. A presentation of a silver cigarette box was made to Mr. Frith by the directors on 31st December.

Mr. R. Spence, A.M.I.E.E., has taken over the management of the Leeds sales office. He joined the company in 1937 after three years' apprenticeship with an electrical contractor, and after a period in the works and at Manchester sales office was appointed to the sales staff at Leeds office in January, 1945. Mr. Spence has been a part-time lecturer in electrical engineering at Huddersfield and Halifax Technical Colleges. During the past twelve years he has been an active member of the North Midlands Centre of the Institution of Electrical Engineers, being a past chairman of the Utilisation Group, and having served on several committees.

Mr. H. Frith

Mr. R. Spence

The **British Central Electrical Co., Ltd.,** held its annual staff Christmas party on 20th December, when a record number of sixty-four sat down to dinner. Bouquets were presented by the staff to the chairman, Mrs. F. J. Conradi, and Mrs. G. Conradi, wife of the managing director, who suitably replied. The toast of the company was proposed by Mr. N. Sheldrick, and Mr. Gordon Marks, secretary to the company, replied. Mr. Gordon



A group at the recent dinner-dance of the I.E.E. Southern Centre held at Southampton (reported in our last issue). Left to right: Professor and Mrs. W. I. Lucas, Dr. L. G. A. Sims (Centre chairman), Mrs. and Mr. G. S. C. Lucas, Mrs. Allibone and Dr. T. E. Allibone

Conradi, welcoming the staff on behalf of his co-directors, thanked them for their loyal co-operation during the previous year, referred to the expansion of the company's activities, and the fact that it was entering its golden jubilee year. After dinner an excellent B.C.E. cabaret was provided.

Mr. R. Robert Isdell-Carpenter has been appointed sales director of the Hotpoint Electric Appliance Co., Ltd., as from 1st January. He succeeds **Mr. O. H. Buckingham,** who will be retiring in June but retains his seat on the board.

Mr. J. S. Cliff, M.I.E.E., who writes in this issue (page 27) on the revision of B.S. 159 dealing with busbar and busbar connections, is manager of the Switchgear Works of the General Electric Co., Ltd., Witton. He joined the G.E.C. in 1925 as assistant engineer in the Switchgear Section of the Development Laboratory and dealt with many problems in connection with circuit-breakers, control and protective gear. He was mainly responsible for the design and construction of the G.E.C. high power testing laboratory, and became manager of the department when it was opened in 1934. In this position he was responsible for all circuit-breaker developments and many special research projects. In 1951 he was appointed assistant manager of the G.E.C. Switchgear Works, becoming manager in 1956.

Mr. J. S. Cliff

Mr. Cliff has served on many B. E. A. M. A., B.S.I. and I.E.C. technical committees dealing with such subjects as standard voltages, insulation co-ordination, l.v. and h.v. circuit - breakers and fuses, and surge diverters. At present he is chairman of the B.E.A.M.A. Switchgear Technical Committee and H.V. Fuse Committee; chairman of the B.S.I. and I.E.C. Surge Diverter Committees; and a member of other B.E.A.M.A., B.S.I. and I.E.C. technical committees dealing with problems relating to switchgear. He has written several I.E.E. and C.I.G.R.E. papers and many technical articles.

Mr. C. T. Melling, first chairman of the Eastern Electricity Board and now a full-time member of the Electricity Council, was recently presented with a television set from the staff of the Eastern Board at the Christmas dinner of the Board's headquarters Sports and Social Association which was held at Wherstead. The presentation was made by the deputy chairman, Mr. H. D. B. Wood, and was subscribed to by members of the staff from every part of the Board's organisation. Mr. Melling had previously received a

Mr. H. D. B. Wood, deputy chairman of the Eastern Electricity Board, presenting a television set from the Board's staff to Mr. C. T. Melling, former chairman of the Board. Standing between them is Mr. H. V. Pugh, present chairman of the Board. Also in the photograph are Mrs. Melling, Mr. H. C. Waters (former deputy chairman, E.E.B.), Mr. R. A. W. Connor and Mr. L. R. Sharp

cigarette casket from the members of the Board and Mrs. Melling had been given a brief case. From his chief officers, Mr. Melling had received a cheque.

The Postmaster General announces that **Sir Lawrence Bragg,** O.B.E., M.C., F.R.S., has consented to become the chairman of the new committee which is to advise him on broad aspects of frequency allocation. He is also appointing to the committee members representative of the radio industry, users' organisations, and Government Departments.

The committee will hold its first meeting as soon as its membership is complete, which is expected to be early this year. Sir Lawrence Bragg is the resident professor and director of the Davy Faraday Laboratory of the Royal Institution. He was director of the National Physical Laboratory in 1937-38 and Cavendish Professor of Experimental Physics, Cambridge, from 1938 to 1953.

Mr. H. Horwood, southern area representative of Measurement, Ltd., for electricity meters, retired at the end of December and he has been succeeded by **Mr. G. G. Hitchcock,** A.M.I.E.E.

Mr. B. D. Jenkins, B.Sc., A.M.I.E.E., has been appointed technical sales manager of Telcon - Magnetic Cores, Ltd. He joined the company in May, 1956, as technical representative for London and the South of England, operating from Mercury House, Theobald's Road, London, W.C.1. He will continue to work from London, but his territory will be extended to include the Midlands and the North of England, thus providing a closer technical liaison between the company and its customers in these areas. **Mr. G. Hamilton** will continue to act as commercial sales manager in the United Kingdom, and additionally will be increasingly concerned with the export side of the company's business.

Mr. B. D. Jenkins

Mr. Ernest A. Mills, who has been in the electricity supply industry for fifty years, retired from the London Electricity Board at the end of 1957. He had been a member since vesting day and was deputy chairman from 1948 to 1953. Mr. Mills was born at Wallasey, Ches., in 1885 and after education at Liverpool College and University he was trained with a firm of marine engineers. He entered the supply industry in 1907 when he joined the Yorkshire Electric Power Co. Four years later he took up a position with the British Thomson-Houston Co. but returned to the supply industry, with the North Metropolitan Electric Supply Co., in 1912. Then, in 1914, he went to the Birmingham Corporation Electric Supply Department and while there was engaged in the construction of the Nechells power station. From 1918 to 1920 he was chief assistant engineer in the Leeds Electricity Department and in 1920 became executive engineer, power stations, with the Shanghai Municipal Electricity Department. While in this position he twice visited the United States to examine and report on electrical operation and administration methods.

Mr. E. A. Mills

Upon his return to this country in 1928 he served as deputy electrical engineer and manager at Leicester, later, in 1931, becoming electrical engineer and manager at Halifax. Then from 1934 until vesting day he

was borough electrical engineer and manager at Hackney.

Among his activities during his long service Mr. Mills was a member of the Council of the former Incorporated Municipal Electrical Association and of the S.E. England Consultative Committee of the Central Electricity Board. He had also served on the E.D.A. and E.R.A. Councils and on several B.S.I. committees. He is also well known for his activities on behalf of the E.I.B.A., particularly in connection with golf competitions.

The Electrical Fair Trading Council has re-elected **Mr. T. W. Heather** as chairman of the Council for 1957-58, and **Mr. A. E. Iliffe** as vice-chairman. **Mr. J. Y. Dick,** of Oliver Melville & Co., vice-president of the E.C.A. of Scotland, has been reappointed to the Council as a representative (in place of Mr. D. G. Lindsay), after a short break of office of eighteen months.

The British Council is sponsoring the visit to India of **Sir Harold Hartley,** president of the Society of Instrument Technology, who will represent the British Association at the Indian Science Congress in Madras from 6th to 12th January. At the Congress Sir Harold will read a paper on "Man, Energy and Life." He will also give a talk on "Production and Productivity" to the Madras Institute of Management.

Mr. V. Easton, B.Sc., A.M.I.E.E., author of the article on "Alternator Ventilation" (page 11), joined the Engineering Department of the Witton Works of the General Electric Co., Ltd., as project development engineer in 1950 and in the last few years has been concerned particularly with the design of large turbo-alternators and the development of simple methods of direct cooling. Mr. Easton was trained at Faraday House and in 1925 was awarded a gold medal as the best student of the year. After obtaining his degree in engineering at London University he joined the Heaton Works of C. A. Parsons & Co., Ltd., and in 1935 was promoted to the senior staff to supervise the design of d.c. and a.c. machines and to handle special technical problems, such as the design of switchgear-testing alternators. In 1943 he read a paper on this subject before the I.E.E.

Mr. V. Easton

An increase of 44 per cent in sales over last year was reported by Mr. C. R. Purley, chairman of **Lec Refrigeration, Ltd.,** at the company's recent annual dinner at Bognor Regis. He said that the increase in demand for the company's products had been anticipated, and replanning of shops and redeployment of labour earlier in the year had enabled the production lines to keep pace with this demand. The new administrative block was going ahead and would facilitate the handling of the additional work now going through. Extensions were also being made to the final line and dispatch bays.

The first general meeting of the **Electrical Trades' Commercial Travellers' Association** will be held on 10th January at the Feathers Hotel, The Broadway, Westminster, S.W.1, at 6.15 p.m. Supper will be available, after which Mr. Hawes will give a talk on "High Quality Reproduction."

The South Wales Branch of the Association held its annual luncheon recently at the Llanrumney Hall Hotel, Cardiff, which was well supported. In the chair was Mr. D. Morris (branch chairman). Mr. H. W. Day, chairman of the United Commercial Travellers' Association, proposed the toast to the E.T.C.T.A., which was replied to by the national vice-chairman, Mr. S. F. Barker. An appeal was made by the branch charity steward, Mr. James, for the Royal Commercial Travellers' Schools, which was well received.

Mr. A. Savage, chief of the Test Department, Brookhirst Switchgear, Ltd., Chester, was recently presented with a cheque to commemorate fifty years' service with the company. Six other employees received 25-year awards. The ceremony took place at a dinner at which 126 employees with 25 or more years' service were present. Mr. J. O. Knowles, a director of Metal Industries, Ltd. (Brookhirst's parent company), addressed the gathering.

Mr. J. E. C. Bailey, C.B.E., chairman and managing director of Baird & Tatlock (London), Ltd., and Hopkin & Williams, Ltd., is leaving the United Kingdom on 18th January to visit the companies' branches, agents and representatives in Rhodesia, South Africa, Australia, New Zealand, Singapore and Ceylon.

The St. Helens Cable & Rubber Co., Ltd., announces the following appointments:—**Mr. H. Lockett** to be director and general manager (formerly director and manager of the cable division); **Mr. W. A. E. Painting** to be manager of the cable division (formerly technical manager of the cable division); and **Mr. B. Esser** to be sales manager of the cable division (formerly London area representative).

The staff annual Christmas luncheon of **William McGeoch & Co., Ltd.,** was held recently when some seventy members of the office staff were present in the staff canteen. Thanks to the company were expressed by Mr. H. Wheeler, manager of the Advertising Department. The works managing director, Mr. P. McGeoch presided and he congratulated Mr. E. A. Savory on his fifty years' service with the company.

We reported last week that **Mr. Norman T. Smith** was retiring from the position of manager of the Nova Scotia Light & Power Co., Ltd. In a letter to us the company express the regret of the directors that ill-health has forced Mr. Smith to resign and their wishes for his speedy recovery. It is mentioned that Mr. Smith was vice-president and president-elect of the Canadian Electrical Association, vice-president of the Canadian Transit Association, chairman of the Power Committee of the Atlantic Provinces Economic Council, and a director of the Electric Construction Co. Canada, Ltd. His address is now 800, High Street, West Palm Beach, Florida.

Mr. G. Gartrell, general manager of G. Ellam, Ltd., has been appointed a director of the company. **Mr. W. Gardner,** formerly commercial manager, has been appointed general manager.

The **Hackbridge Group "25" Association** held its annual dinner at Shinner's Restaurant on 14th December. The Association is formed by those employees with a minimum of twenty-five years' continuous employment with the group. Three members of the Hackbridge Cable Co. present at the dinner were Mr. W. McDonald (managing director), Mr. G. Duberry and Mr. R. Haite, who have each completed forty-two years' service.

Mr. G. H. Mooney, managing director of Dishmaster (New Zealand), Ltd., arrived at London Airport on 19th December where he was greeted by Mr. J. Cotterill, general manager of Dishmaster (London), Ltd. Mr. Mooney is carrying out a world sales tour for the Dishmaster dish-washing machine.

The A.E.I. Lamp & Lighting Co., Ltd., announces the appointment of **Mr. H. G. Lilley** as manager of the Lighting Department in succession to **Mr. C. W. M. Phillips,** who has resigned to take up an appointment outside the A.E.I. Group. Mr. Lilley left the Midland region of the company in October to become deputy manager of the Lighting Department. His new appointment is effective from 1st January. Mr. Phillips received his training with the B.T.H. Company and joined the Lamp Department as an electrical engineer in 1934, becoming assistant manager, Lighting Department, in 1948 and manager in 1950.

Following the success of the two previous years, the **Revo Electric Co., Ltd.,** has once again awarded prizes to its employees in its "Good Housekeeping" competition. The departments are divided into three "leagues"

dependent on the type of work involved, and marks are awarded for shop tidiness, general appearance and process involved. The prizes were presented on 20th December by Derek Roy, the comedian.

Tickets are still available for the dinner-dance which is to be held by the Utilisation Section of the **Institution of Electrical Engineers** at the Café Royal, Regent Street, W.1, on 15th January (7 for 7.30 p.m.). Application should be made as soon as possible to the Secretary, the Institution of Electrical Engineers, Savoy Place, London, W.C.2.

Mr. F. P. Bentham has been appointed a director of Strand Electric Holdings, Ltd., in place of **Mr. L. G. Applebee,** who has resigned.

OBITUARY

Mr. G. H. Fletcher.—The death occurred on 20th December, at the age of seventy-one, of Mr. George Herbert Fletcher, O.B.E., M.I.E.E., M.I.Mech.E., who was for many years associated with the Metropolitan-Vickers Electrical Co., Ltd., and at the time of his death was consulting engineer to the Traction Department of the General Electric Co., Ltd. He was the Faraday Lecturer for the present session of the Institution of Electrical Engineers, and an account of his career was published in our issue of 29th November last, in which issue we also published an abstract of his lecture on "The Electrification of the British Railways."

The late Mr. G. H. Fletcher

Mr. Fletcher was associated with the Metropolitan-Vickers Electrical Co., Ltd., and its predecessor, the British Westinghouse Co., from 1914 to 1954; he retired from the position of general manager of the company's Sheffield works in 1951, but continued for a time as consultant on the design of motors and generators for electric traction. He remained on the board of the Metropolitan-Vickers Electrical Export Co. until 1953. Mr. Fletcher had acted as a consultant to the Traction Department of the General Electric Co., Ltd., for the past three years.

Mr. J. Beresford-Horniblow, a prominent member of the Birmingham Centre of the Illuminating Engineering Society, died on 17th December at the age of sixty-one. Mr. Beresford-Horniblow became a member of the Society in 1948, but his interest in lighting extended back to the early part of the century. He was a serving member of the main committee of the Centre, and its Press officer. Perhaps his greatest work for the Centre was the building up of the School Lecture Panel, and in this respect he raised the whole status of its activities, lectures being given to science sections of leading grammar schools, colleges of technology and universities. He contributed an article on the I.E.S. School Lecture Panels to the *Electrical Review* for 20th September, 1957. He was a member of the Inter-State Color Council of America, and the optical and colour groups of the Physical Society.

Mr. S. T. Pemberton, M.I.E.E., A.M.I.Mech.E., died on 19th December at the age of eighty-three. He founded S. T. Pemberton & Co., Ltd., Birmingham, in 1907, and although he retired from active business in 1934, he remained on the board until his death.

Mr. R. E. Livesley, B.Sc., A.M.I.E.E. —The death has occurred, at the age of sixty-eight, of Mr. Robert E. Livesley, who retired in 1955 from the position of manager of the Newark District of the East Midlands Electricity Board. Before nationalisation he had been borough electrical engineer of Newark since 1929.

Mr. H. Wilson Milnes, engineer of the former Northallerton Electric Light & Power Co., and at his retirement in 1944 district manager of the North Eastern Electric Supply Co., died on 16th December.

Sir Thomas Bethell, who died on 23rd December, was deputy chairman of the former County of London Electric Supply Co., Ltd., and a director of its associated companies.

Lt.-Col. Sir Merrik R. Burrell, Bt., C.B.E., whose death occurred on 22nd December at the age of 81, was a member of the South Eastern Electricity Board from 1948 to 1954.

WILLS

Lord Bennett of Edgbaston, joint managing director and former chairman of Joseph Lucas (Industries), Ltd., who died on 27th September last, left £312,353 gross (£298,631 net).

Mr. L. A. Smart, M.I.Mech.E., M.I.E.E., consulting engineer, who died on 2nd June last, left £56,922 gross (£56,739 net).

Computation and Automatic Control

THE rapid growth of automation, which covers computation, process control and data processing generally, led to a decision early in 1957 by some twenty bodies of the learned society type having interests in these fields, or in their social and economic implications, to set up a central organisation to provide more effective liaison between the interested bodies, to be known as the British Conference on Automation and Computation. This has been organised to consist of three groups, as follows: A. The British Group for the Engineering Applications of Automation; B. The British Group for Computation and Automatic Control; and C. The British Group for the Sociological and Economic Aspects of Automation Techniques.

At a meeting held on 20th December Group B—The British Group for Computation and Automatic Control—was formally constituted by 23 bodies including organisations representing chemists, actuaries, bankers, accountants, office management, physicists, administrators and engineers. Among them are the Institutions of Civil, Electrical and Mechanical Engineers.

The objects of the Group are: (*a*) To foster the development and applications of automatic controls, computing and data processing equipment and programming techniques. (*b*) To afford a common meeting ground for the co-ordination and extension of activities falling within the purview of the Group. (*c*) To maintain liaison with other Groups of the British Conference. (*d*) To encourage and co-ordinate the presentation at international conferences of British papers on subjects falling within the purview of the Group. (*e*) Through the General Committee of the British Conference, to maintain liaison with corresponding national committees of other countries which support such international conferences.

Mr. T. E. Goldup, C.B.E., President, I.E.E., was elected chairman of the Group, with Messrs. J. F. Coales, O.B.E., M.A. (Society of Instrument Technology), and E. M. Renals (Institute of Cost and Works Accountants) as vice-chairmen. Mr. J. D. Green (Institute of Chartered Accountants in England and Wales) was elected honorary treasurer, and Mr. W. Bamford (I.E.E.) honorary secretary, and the offer of the I.E.E. to provide secretarial services for the Group was accepted. One representative of each of the following societies was elected to serve with the honorary officers as the Executive Committee of the Group:—The British Computer Society, the Institute of Bankers, the Institute of Physics, the Institution of Production Engineers, the Iron and Steel Institute and the Office Management Association.

At their first meeting, the members of the Group interchanged information as to their forthcoming activities in the field of automation, and made arrangements so that the Group and the British Conference could act as a clearing house for information on activities of this kind.

The Group constitution provides for the election of additional member societies; those interested should communicate with the B.C.A.C., Group B, c/o The Institution of Electrical Engineers, Savoy Place, W.C.2.

PARLIAMENTARY REPORT

Atomic Power and Amenities

Anxiety about the effect of the atomic power programme upon unspoilt countryside was expressed by Mr. Blenkinsop in an adjournment debate before the House of Commons rose for the Christmas recess. He said it was not satisfactory merely to rely on public inquiries as each specific project came forward. It should be possible, he thought, to form a central consultative committee who could be called upon to give advice on the long-term programme.

Mr. David Renton, Parliamentary Secretary, Ministry of Power, said it was not widely enough understood how thorough, careful, and effective were the various means that Parliament had established for preserving amenities. The present machinery provided not only for a careful and thorough scrutiny of each project, but also for the conservation of amenity on a national scale.

Road Lighting Uniformity

In another debate Mr. Arthur Moyle called attention to the lack of uniform and continuous lighting on the roads which, he contended, was one of the main causes of accidents. In England and Wales there were 3,200 different lighting authorties and if, in addition, the parish councils took the Minister of Housing at his word and decided to exercise their lighting powers, there would be 8,000 authorities. He suggested that joint standing committees of neighbouring local authorities should be established, so that they could discuss their lighting plans and try to achieve uniformity in their new lighting installations.

In 1955 and 1956 the total amount spent by local authorities on lighting was about £12 million a year, whereas the total contribution from the Ministry of Transport was no more than £133,000. Local authorities were right in saying that their ratepayers should not be saddled with the cost of lighting installations which were part of a national service and which should be grant-aided as well as rate-borne. There was no reason why the lighting installations on trunk roads should not rank for 100 per cent grant, as road improvements did.

The Road Laboratory Research Committee estimated that the cost of road accidents to the nation was about £170 million. Northampton Borough, which was the first authority to institute a complete scheme of fluorescent lighting, achieved a reduction in road accidents of 30 per cent.

Mr. G. R. H. Nugent, Parliamentary Secretary, Ministry of Transport, said he hoped that eventually there would be a universal standard for trunk routes in urban and semi-urban areas. The Government had asked the Ministry of Transport divisional road engineers, in conjunction with the highway authorities, to make a survey of street lighting on all trunk and classified roads throughout the country. This would be the first step to considering what action should be taken to solve the problem. In the meantime, he would ask the divisional road engineers to consult lighting authorities in large conurbations and adjacent to each other, and suggest that they should form a local joint advisory committee to co-ordinate street lighting in the whole area.

Home Safety

Several references to the fact that there are still in use many old-type electric fires which do not have proper guards on them were made during a debate on safety in the home. Mrs. McLaughlin said it was difficult to get manufacturers to take up the manufacture of some of the new equipment now being invented to prevent accidents because of the incidence of purchase tax. There was an excellent invention for preventing flex from trailing from an electric fire. Another device, worked from a battery, was intended to prevent old people from being locked in a bathroom. Even more wonderful, was a new type of central light switch for people who were incapable of movement. Stooping to turn on a switch was often a major effort for an old person; plugs at waist level were much more satisfactory.

Mr. A. E. Hunter said big improvements had been made in the design of electrical apparatus but he thought the Home Office should give a lead to the national boards and the electrical manufacturers to institute safety weeks, when demonstrations would be given of the proper use of equipment.

Mr. J. E. S. Simon, Under Secretary, Home Office, said that the Minister of Power had asked the nationalised industries to pay particular attention to this problem of home safety. There was no question that the electrical industry had a very good record. Considering the enormous growth in the use of domestic electrical appliances there had been only a minimal increase in home accidents from that source.

Deferment of Graduates

A statement about the deferment of science and engineering graduates in 1958 was made by Mr. Iain Macleod, Minister of Labour, in reply to Mr. A. E. Cooper. The Minister said that after consulting his Technical Personnel Committee he had decided that science and engineering graduates with second class honours who had also taken a higher degree, and had completed a course of study or training in 1958, might be granted indefinite deferment on taking any employment in this country for which a science or engineering qualification of degree standard was required. Indefinite deferment would also be granted next year to graduates with third class honours or pass degrees in chemistry or one of the biological sciences, and to graduates with ordinary or general degrees in science, if they took an approved teaching post in a secondary school.

The Metric System

Mr. Kirk asked the President of the Board of Trade if his Department would take part in the forthcoming inquiry by the British Association into the practical implications of a change-over to the metric system in this country.

Sir David Eccles replied that the expert knowledge of his Department would be at the Association's disposal. He welcomed the initiative which the British Association had taken in this important matter.

Taxation Policy and European Free Trade

In a question about the proposed European Free Trade Area, Mr. Nabarro called attention to Sir Leonard Lord's statement that Government policies which affected home market sales through credit restrictions, purchase tax, profits tax, hire purchase and other controls must be revised to give British industry parity of home market conditions with Continental competitors.

Mr. Powell said that purchase tax was one of the factors which had to be considered.

Commodity Costs and Retail Prices

When Mr. Birch, Economic Secretary to the Treasury, was questioned about the fall in commodity prices and the rise in retail prices, he said that it took time for falls in import prices to work their way through the system, and home costs were four or five times as important as import costs in the final price of an article.

Mr. Arthur Lewis retorted that import prices had been falling since 1951, yet at home we had reached the highest cost of living ever.

South Lancashire Transport Bill

A Bill promoted by the South Lancashire Transport Co. seeks to transfer the company's undertaking to the Lancashire United Transport Co. One clause authorises the discontinuance of the running of trolley-buses.

VIEWS on the NEWS

By REFLECTOR

MR. A. R. COOPER, who has been appointed a regional director by the Central Electricity Generating Board, answers, presumably for the last time as divisional controller, questions put to him through *Northern Lights*, the magazine of the North West, Merseyside and North Wales Division. One questioner wanted to know why the C.E.A. did not choose a place in Wales with a pronounceable name when looking for a site for a pumped storage station; he suggested finding a new name for the place.

Mr. Cooper replies that the questioner is probably referring to the nuclear power station at Trawsfynydd (which is to be connected with the Ffestiniog pumped storage scheme). He says he can think of nothing more likely to irritate a true Welshman than to suggest that the original Welsh name could be improved upon.

> "We might have found a place with a less difficult name than 'Trawsfynydd,' but it would hardly have been worth while to move the station. As a matter of interest the Welshman pronounces it 'Trowsvunith.' This is a challenge we ought to accept."

* * *

It seems that miners in Yorkshire are beginning to consider the use of raw coal a bit primitive. The *Daily Mail* reports that pitmen at Wath-on-Dearne have been instructed by the local council on proper methods of stoking their domestic fires. Coal is so plentiful that they bank up their fires and burn out the grates rather too soon. A local trade union secretary admitted that the excessive allowance of coal—ten tons a year—was a "problem." Most men sold back some of their concessionary coal to the N.C.B. for £1 a ton but even then they had plenty. He went on to say:—

> "We are discussing suggesting at national level that our miners should be allowed free gas and electricity in exchange for giving up most of their coal concession."

The chairman of the council explained that the houses concerned had only one fireplace to heat the living room and the water. The other rooms were warmed by electricity or gas.

* * *

Hydro-electric schemes, even more than steam power stations, are prone to upset the inhabitants of the areas in which they are to be carried out. I may instance the St. Lawrence River development which, under the heading "Mohawks on warpath demand to see Ike," received attention in the *Sunday Express*. According to a New York correspondent Chief Standing Arrow of "the great Mohawk nation" accuses the palefaces of stealing their land in New York State. The chief "a 24-year-old ex-Navy man, donned ceremonial feathers over his white jacket" and announced that the Indians were taking their case to President Eisenhower or the Defence Secretary and, if they were rejected, to the League of Nations; if necessary they would finally resort to arms. It all sounds very picturesque and alarming but I doubt whether we shall hear much more of this Sunday sensation.

* * *

Further news of the unceasing conflict between owners of salmon fishing rights and the North of Scotland Hydro-Electric Board is that a £14 million scheme at Strathfarrar and Kilmorack, Inverness-shire, is being delayed by an inquiry into objections by local landlords. According to the Scottish edition of the *Daily Herald*, the Board proposes to provide means for enabling salmon to reach their breeding grounds at a cost of £375,000. The fishing-rights owners are dissatisfied with this and at the inquiry their counsel went so far as to suggest that further hydro-electric schemes were a waste of public money when atomic power stations were to be built in Scotland. Naturally the chairman of the Board, Mr. Thomas Johnston, did not agree. He considered that the soundest and most profitable way of running nuclear power stations was in conjunction wtih hydro-electric schemes.

* * *

Interest has been aroused in the United States by the announcement of the decision to lay a cross-Channel cable. The *Electrical World* (New York) says:—

> "Seemingly trivial matters—such as what a Frenchman eats for breakfast or what time an Englishman leaves for work in the morning—have contributed to the economic feasibility of the long discussed link between electric systems of Britain and France."

In further explanatory notes one reason for the difference in French and British peak-load times is said to be that "Britains (*sic*) traditionally eat a much heavier breakfast than the French."

* * *

Eighty years ago the telegraphic industry, which was the germ of modern electrical industry, seemed to be having a bad time. Surveying the past year in its issue of 1st January, 1878, the *Electrical Review* said:—

> "The condition of business amongst telegraph contractors during the year cannot be called other than dull. Contractors who do not supply the home government with materials, depend for orders on foreign governments, and it is well known that there is very little activity amongst these at present, owing to the reserved condition of the money market. Contractors are even reduced to tendering for orders at rates under cost price, so as to be able to keep their machines in operation and avoid deterioration of their plant. In default of large foreign orders, attention has been turned to furnishing domestic articles, such as electric bells, telephones, and electro-magnetic engines for sewing machines."

I wonder what these last-mentioned devices were like; "engines" sounds pretty formidable.

INDUSTRIAL NEWS

Anglo-Italian Nuclear Power Agreement

On 28th December an agreement was signed on behalf of the United Kingdom and Italian Governments by which the United Kingdom Atomic Energy Authority undertakes certain obligations in the sphere of atomic power development. The Commission will sell to the Italian Government, or assist it to buy, fuel for use in research and power reactors; assist in the supply of reactors from the United Kingdom; process used fuel; assist in the provision of facilities for the production and processing of fuel in Italy; and arrange for the training of Italians in atomic science.

The agreement follows upon the recent announcement that the Nuclear Power Plant Co. was to supply a 200 MW nuclear power plant to Italy (see *Electrical Review*, 29th November).

Government Copper Stockpile

The Board of Trade announced on 16th September last that in view of the disturbed state of the copper market it had decided not to offer for sale for the time being any of the 27,000 tons of copper which had previously been announced as available. The Board then said that it would review this decision towards the end of the year. This review has now been made and the Board has decided on a further postponement. An announcement will be made when it is decided to resume sales.

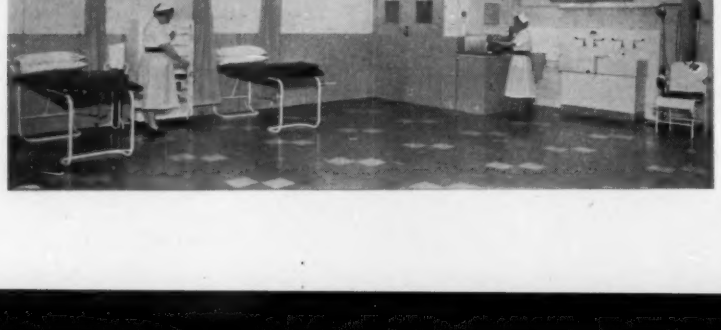
Plessey Medical Centre

One of the most up-to-date medical centres of its kind in the country was inaugurated at the Ilford works of the Plessey Co., Ltd., on 19th December. Within the department there is sufficient room and equipment to give treatment before the patient is either sent home or to hospital by the company's own ambulance. There is also a recovery room for those patients who are considered to be in need of rest before transport, and, if necessary, the patient can be kept comfortable with continuous medical supervision. The department is divided into male and female sections, each being supervised by a senior nursing sister and each section equipped with its own instruments.

Specially tinted fluorescent lighting is installed throughout the building and floors have been laid in a simple but effective design of thermoplastic tiles in three colours. Heating in the reception areas is by convector type heaters.

Dr. J. H. S. Morgan, M.R.C.S., L.R.C.P., is head of the staff of seventeen, and the centre has adequate facilities to deal with all accident cases, and to provide the standard forms of physiotherapy treatment. It was officially opened by the Mayor of Ilford, Councillor A. R. Sherrill, J.P.

The new Plessey medical centre



Manning of Diesel and Electric Locomotives

A further meeting was held in London on 18th December between representatives of the British Transport Commission and of the two railway trade unions concerned (the A.S.L.E. & F. and the N.U.R.) to discuss the proposals which have been under examination for the manning of diesel and electric locomotives on British Railways. After the meeting it was stated that agreement had now been reached as to the recommended periods and distances for which such locomotives, or trains composed of multiple-units, shall be manned by one man or by two men, and on other questions related thereto.

The recommendations agreed to are subject to approval by the Commission and by the executives of the trade unions concerned, and details are not being published pending consideration by these bodies.

New Malayan Cable Company

British Insulated Callender's Cables, Ltd., and the Telegraph Construction & Maintenance Co., Ltd., announce the formation of Malayan Cables, Ltd., in the Federation of Malaya with an initial authorised capital of five million Malayan dollars (£583,333). A factory is being erected in Kuala Lumpur which, at the outset, will produce solid and stranded overhead conductors and thermoplastic and rubber-insulated cables; in due course, the scope of manufacture will be extended to other types of cable. The British sponsors will provide technical and commercial advice to the company.

Electrical Exports by Air

Of the £115·3 million of electrical machinery, apparatus and appliances exported from the United Kingdom in the six months January to June, 1957, the *Board of Trade Journal* states that £5·4 million, or 5 per cent of the total, was sent by air. This was over a third more than in the corresponding period of 1956. Electrical goods represent 10 per cent of the total exports by air and are the third largest single item, being exceeded by machinery (other than electrical), which was valued at £9·7 million, and silver, platinum and jewellery totalling £9·2 million. Of the £12·7 million of electrical machinery, apparatus and appliances that were imported during the first six months of 1957, £3·5 million or 27 per cent was carried by air.

Steam Turbine Operation

The December issue of the "Broadsheet" of the City and Guilds of London Institute, Gresham College, Basinghall Street, London, E.C.2, reports that regulations and a syllabus for examinations in steam turbine plant operation have been drawn up. They are included in the Institute's Programmes for 1957-58 (Programme A) obtainable from the Institute at 4s 6d a copy.

The examination consists of a written paper, and a practical/oral test which is carried out in a turbine house. The practical/oral test will be carried out by local examiners appointed by the Institute. Candidates who are successful in both parts of the examination will be awarded a pass certificate and details of the type of plant on which the practical/oral test was taken will be endorsed on this certificate. The syllabus includes sections on properties of steam, steam utilisation, steam turbine plant, turbine plant auxiliaries, turbine-driven plant,

Christmas illuminations in King s Road, St. Leonards-on-Sea

turbine plant operation, instrumentation, turbine plant efficiency and log records.

The first main examination is to be held in May next but a special examination for Central Electricity Authority employees was held last October. Copies of the question paper used in this examination may be obtained from the Institute (6d each).

Productivity and Wages

Barclays Bank Review publishes a series of coloured charts showing industrial production in the United States, the United Kingdom, Germany and France from 1901 to 1956 and, in detail, production of leading United Kingdom industries. Employment and earnings are also depicted. It is stated that although manufacturing output fell in 1956, employment rose slightly so that productivity declined by 2 per cent, although the average annual earnings per employee rose by 8 per cent. Consequently labour costs, reckoned as the earnings per unit of output, increased by about 10 per cent, after a relatively small rise in 1955 and practically none in 1953 and 1954.

Power Station Equipment for South Australia

The Electricity Trust of South Australia has placed orders for transformers and switchgear with Australian Electrical Industries (Pty.), Ltd., acting on behalf of the Metropolitan-Vickers Electrical Export Co., Ltd. These orders, to a total value of about £500,000, were obtained in face of severe Continental competition.

The equipment for Port Augusta includes both transformers and switchgear. Three 67 MVA three-phase 50 c/s 11·3/275 kV transformers will be supplied to step up the generated voltage for transmission to Adelaide. These will have Metropolitan-Vickers type "M" resistor transition tap changers fitted on the h.v. side for a tapping range of 20 per cent in eighteen steps, with parallel and independent remote electrical control. Cooling will be "oil natural" for reduced output, and by the use of fans and oil pumps for full output. Also for Port Augusta are four 8,000 kVAr shunt reactors of the coreless, iron-shielded type with graded insulation. These are to form a three-phase star-connected bank (with one spare unit) for use direct on a 275 kV earthed neutral system. One transformer and the four reactors are due for completion in May, 1959, and the remaining transformers in May, 1960, and May, 1961.

A separate order is for twelve Metropolitan-Vickers type GA10X8F 275 kV air-blast circuit-breakers and associated equipment.

Seven circuit-breakers, three of which will be fitted with high-speed reclosing equipment, are to be installed at the Port Augusta power station, together with the necessary central air compressing, drying and storage plant for their operation. Also included are twenty-four single-phase 275 kV outdoor current transformers and six capacitor voltage transformers.

The remaining five circuit-breakers, four of which are arranged for high speed reclosure, will be installed at Magill substation. Compressor equipment is included, and as Magill will be a mesh station, current transformers are to be fitted on both sides of the breakers, making a total of thirty 275 kV multi-secondary outdoor current transformers.

Eastern Board's Sales Conferences

Over the last few weeks the Eastern Electricity Board has held a series of sales conferences at the Hadleigh Hotel, Clacton-on-Sea, designed to review the present and future trading position of the Board with members of its sales staff. Talks were given on service centres, publicity, tariffs, system development, and on sales, service and contracting generally. Following each of the talks there was a discussion.

American Nuclear Reactor Costs

In its "Electrical Business Outlook" recently the *Electrical World* (New York) said that "the U.S. atomic power picture has been clouding rather than clearing." It goes on to mention that the Atomic Energy Commission had cancelled its order to AMF Atomics for a 22 MW reactor at Elk River, Minnesota, when costs went up to $11·7 million, against an original estimate of $8·9 million. The Indian Point plant of the Consolidated Edison Co. of New York was quoted at $90 million instead of the original $55 million. The Sylvania-Corning Nuclear Corporation had abandoned plans for a Massachusetts nuclear components plant and the Foster-Wheeler Corporation "broke up its power reactor team after A.E.C. [Atomic Energy Commission] balked at its higher price tag on a project for Wolverine Electric Cooperative Association of Big Rapids, Mich."

The value of arrears of private atomic power projects had risen from $84·5 million in September, 1955, to $167 million in 1956 and to $227 million in September last. "The figures emphasise that cheap nuclear power is not developing as rapidly as was expected three years ago," when manufacturers were over-optimistic. It is further said that practically all the contracts awarded in 1957 were for research; there were no large-scale power plant contracts.

Lighting in St. Bride's

The accompanying picture shows the nave of St. Bride's Church, Fleet Street, London, shortly after the rededication ceremony attended by the Queen on 19th December. Wrecked by bombs 17 years ago, the interior of this famous Wren masterpiece has

The nave of St. Bride's Church, Fleet Street, illuminated by "Atlas" fluorescent tubes

now been completely restored and one of the most notable new features is the use of "Atlas" fluorescent tubes to provide the main lighting of the church. The lighting fittings are concealed beneath the arches flanking the nave and throw light upwards on to the decorated gilt and white ceiling. Fifty-four 5ft "de-luxe" warm white tubes are used, operated from a dimmer board with two control panels near the north door. One panel provides normal switching of the lighting on seven circuits, the other gives master dimming of all seven circuits simultaneously and each circuit is provided with a switch to select dimming, full brilliance or off, independently of

the other six; intensity is 18 lumens per sq ft at floor level. Seven pairs of thyratron valves are used. The electrical contractors were L. T. Hall, Ltd., and the lighting scheme was designed by Mr. C. S. Hall, A.M.I.E.E., in co-operation with the architect, Mr. W. Godfrey Allen, M.A., F.S.A., F.R.I.B.A.

Veritys and Nelson Engineering

Veritys, Ltd., and the Nelson Engineering Co., Ltd., of Nelson, Lancs., have entered into an agreement whereby Veritys sales organisation will handle throughout the world the electrical equipment manufactured by the Nelson Engineering Co. These products will be marketed under the name Verity "Nelson." The range of a.c. and d.c. motors, switchgear, fans and lighting equipment at present manufactured and marketed by Veritys under their own name is now augmented by the transformers, marine equipment, f.h.p. motors and other products manufactured by Nelson Engineering.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £182 15s 0d
Fire Refined 99·70%	ton £181 0s 0d
Fire Refined 99·50%	ton £180 0s 0d
COPPER Tubes ..	lb 1s 8½d
Sheet	ton £209 5s 0d
H.C. wire and strip ..	ton £229 15s 0d
LEAD, English ..	ton £73 15s 0d
Foreign	ton £72 0s 0d
MERCURY	flask £69 0s 0d
TIN, block (English) ..	ton £730 5s 0d
ZINC, G.O.B. Foreign	ton £62 5s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 5½d
Sheet	ton —
Wire	lb 2s 3d
PHOSPHOR BRONZE Wire	lb 3s 6½d
PLATINUM	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 24½d—24⅝d

"Ekco" Designer Wins Horners' Award

Mr. B. Smith, N.D.D., L.S.I.A., of Ekco Plastics, Ltd., has won the Worshipful Company of Horners' award, 1957, in the annual competition for the best design in plastics by a designer under thirty years old. The winning entry was an illuminated "Keep Left" bollard. Mr. Smith is a member of the industrial design studio of Ekco Plastics, Ltd.

Self-Service Launderettes

The thousandth Bendix self-service launderette was opened yesterday (Thursday) at Murray Street, West Hartlepool. It is the fourth in West Hartlepool and the sixty-first in the North-East counties. Starting in 1950, the self-service launderette has become established as a national chain and is claimed already to surpass in numbers of shops any of the other well-known chain stores.

National Society for Clean Air

The National Smoke Abatement Society has changed its name, and from New Year's Day became the National Society for Clean Air. The change reflects a wider scope for its activities and recognition of the fact that to-day the term "smoke abatement" is too narrow and too weak. The Society also becomes an incorporated body, being registered as a company limited by guarantee and without share capital, and with permission to omit the word "Limited" from its name.

Floor Polishers for the U.S.A.

Black & Decker, Ltd., the electrical tool manufacturers, of Harmondsworth, Middlesex, have opened up the American market for their new lightweight electric floor polisher attachment, developed in Britain by this company. They have secured an order for 35,000 of these new polishers. Sales to the American market will be developed by the American Black & Decker Co.

Lindsey Electrical Contracts

With some opposition from councillors, Lindsey (Lincs.) County Council has agreed, for a trial period of six months, to allow electrical and heating schemes to be carried out by firms selected by the county architect in conjunction with the chairman of the County Council and the chairman of the General Purposes Committee. It was stated that the action was being taken because of a shortage of specialists.

North Western Board Reorganisation

The North Western Electricity Board proposes to make a number of changes to some of its Sub-Area and District boundaries in order to improve efficiency. This reorganisation is being discussed at representative meetings with employees and others interested.

The main proposal is to reduce the number of Sub-Areas from seven to six and the number of Districts from twenty-nine to twenty-four. It is proposed to amalgamate the greater part of No. 3 Sub-Area (centred on Oldham) with No. 7 Sub-Area (centred on Hazel Grove). The remaining part of No. 3 Sub-Area would be amalgamated with No. 5 Sub-Area (centred on Blackburn). The number of Districts is to be reduced partly by amalgamation and partly by rearrangement of boundaries. No changes are proposed in No. 1 Sub-Area (centred on Manchester) and No. 6 Sub-Area (centred on Kendal). No staff will be declared redundant, but economies will be achieved as staff retire or leave to take up other positions.

In the new No. 3 Sub-Area the following appointments have been made and will take effect from 1st April:—Manager, Mr. F. J. Cole; engineer, Mr. N. Jones; accountant, Mr. C. Broucher; secretary, Mr. H. Renshaw. Mr. F. Catherall will be consumers' engineer until his retirement on 14th November, 1958, when Mr. A. D. Pluck, who has been consumers' engineer for No. 7 Sub-Area, will take over the position. Mr. J. Mills, manager of No. 7 Sub-Area, Mr. H. L. Partington, sub-area engineer, and Mr. S. Shrigley, sub-area secretary/accountant, are being seconded for special duties.

Calendars and Diaries

Pictures of British ceremonies and institutions illustrate the calendar of the Fischer Bearings Co., Ltd., which has large monthly sheets showing also the preceding and following months.

A black and white drawing of the Mill House, Sproughton, Suffolk, makes an excellent picture for the calendar of Gilflex Conduits, Ltd., which has monthly slips showing the preceding and following months.

The pocket diary received from Porter Electrical Products, Ltd., contains many pages of technical data, sectional maps, and plates illustrating causes of television interference.

The calendar of Siemens Edison Swan, Ltd., has monthly sheets each of which has an attractive picture of an English or Welsh beauty spot.

A duck with her young makes a colourful picture for the calendar of the Lindley Thompson Transformer & Service Co., Ltd., which has monthly slips.

Trade Announcements

As from 6th January the **London Electric Wire Co. & Smiths, Ltd.,** and its associated companies, Frederick Smith & Co., the Liverpool Electric Cable Co., Ltd., and the Vactite Wire Co., Ltd., are moving their Brighton branch office and stores to new and larger premises at 8, Black Lion Street. The telephone number remains the same—Brighton 24850.

Ekco-Ensign Electric, Ltd., have appointed Mr. L. D. T. Williams as their representative covering South West Wales. He will operate from the Western Sales Office, 50, Bridge Street, Cardiff.

The Norwich area office and stores of the **A.E.I. Lamp & Lighting Co., Ltd.,** St. Michael's Chambers, St. Andrew's Street, Norwich, is now closed. Customers in the Norwich area should address orders and inquiries to 133, Fitzroy Street, Cambridge (telephone: Cambridge 54370). Mr. V. C. Davies continues as area superintendent, assisted by Mr. H. C. Dain.

The London office of the **Pulsometer Group** is now at Pulsometer House, 20-26, Lamb's Conduit Street, W.C.1 (telephone: Holborn 1402).

Busbars and Busbar Connections

Implications of New British Standard

By J. S. CLIFF, M.I.E.E.*

THE recently published revision of B.S. 159, "Busbars and Busbar Connections," differs considerably from the 1932 edition which it supersedes. It conforms much more closely with present-day British Standards for switchgear, thus facilitating the correlation of the design of the busbars and connections with that of the associated items of apparatus. Its publication, which is long overdue, will therefore be welcomed both by manufacturers and users, who have found the 1932 edition inadequate for many years, and have been forced to introduce standards of their own in order to keep busbars and connections in line with the progress which has been made with standards for the associated apparatus.

The scope of the new standard now extends to busbars and connections for 200 A and above, and is mainly applicable to a.c. power switchgear, although parts of the standard are also applicable to busbars and connections for d.c. apparatus. The definitions have been extended to include bushing type busbars and compressed gas insulated busbars.

TABLE I.—CLEARANCES FOR OPEN AND ENCLOSED TYPE BUSBARS (ELECTRICALLY NON-EXPOSED)

1	2	3	4	5
Rated voltage (kV)	Minimum clearance to earth in air (inches)		Minimum clearance between phases in air (inches)	
Up to and including	Open	Enclosed	Open	Enclosed
0·415	¾	¾	1	¾
0·6	1	¾	1½	¾
3·3	2	2	2	2
6·6	2½	2½	3½	3½
11	3	3	5	5
15	4	4	6½	6½
22	5½	5½	9½	9½
33	8½	8½	14	14

The ratings of busbars have now been made similar to those for other apparatus and are specified in terms of voltage, normal current, frequency, and short-time current. The last rating is similar to that for circuit-breakers, and has alternative one- or three-second ratings, depending upon the ratio of the normal current to the short-circuit current. Where this ratio is equal to or less than 40, the busbars have a three-second rating, and where the ratio is more than 40 the time is reduced to one second. Where busbars are protected by circuit-breakers having quick-acting trips or fuses which have a cut-off current, the full short-circuit current is restricted and this has been taken into account when applying the short-time rating to busbars which are protected by such apparatus. Where enclosed busbars can form separable units, then it is necessary for them to be provided with a rating plate giving details of the ratings which are applicable.

The standard rated voltages have been brought into line with B.S. 77 which standardises voltages of systems. The rated normal currents have been standardised on values similar to those already applicable to circuit-breakers. The temperature rise which is allowable for busbars has been increased to 50 deg C for all current ratings, this being based upon an ambient temperature of 40 deg C, with an average not exceeding 35 deg C when measured over a period of 24 hours.

In the 1932 edition, the busbar materials were specified in considerable detail, together with standard sizes and tolerances. These details have now been removed from the revised standard as separate British Standards have been prepared for copper and aluminium sections for use for electrical purposes, and these new standards now contain the data in respect of tolerances and material standards. Clearance distances are specified for all the usual arrangements of busbars. Open and enclosed busbars with air insulation and suitable for use on electrically non-exposed systems are specified in Table I.

The clearances for outdoor open type busbars suitable for use on electrically exposed or non-exposed systems up to voltages not exceeding 15 kV, are as given in Table II, while Table III sets out the clearances for busbars which are immersed in oil or compound insulation.

Busbars of the open outdoor type for voltages of 22 kV and above have clearances which are related to the impulse voltage withstand level, and these are given in Tables IV and V. Creepage distances are not specified, but some guidance is given in an appendix.

Owing to the very large variety of different arrangements of busbars and busbar connections, it is impracticable to make even type tests on all of these. Designs may therefore be substantiated by test data and experience in service obtained on comparable arrangements. The most important type test which has been included in the new edition is that relating to the short-time current. For this test, the busbars must be arranged to produce as far as practicable conditions equivalent to those to which the busbars or connections will have to

* Manager, Switchgear Works, General Electric Co., Ltd.

TABLE II.—CLEARANCES FOR OUTDOOR TYPE OPEN BUSBARS NOT EXCEEDING 15 kV RATED VOLTAGE FOR ELECTRICALLY EXPOSED OR NON-EXPOSED INSTALLATIONS

1	2	3
Rated voltage (kV)	Minimum clearance to earth in air (inches)	Minimum clearance in air between phases (inches)
Not exceeding		
6·6	5½	7
11	7	9
15	8½	10½

TABLE III.—CLEARANCES FOR BUSBARS AND BUSBAR CONNECTIONS IMMERSED IN OIL OR COMPOUND

1	2	3
Rated voltage (kV)	Minimum clearance to earth (inches)	Minimum clearance between phases (inches)
Up to and including		
0·6	¾	¾
3·3	1	1
6·6	1	1
11	1	1½
15	1½	1½
22	1½	2½
33	2½	3½

withstand in service. The rated short-time current is specified in terms of an r.m.s. value for a stated time, but also at the start of the test the busbar must withstand the highest peak value of the major current loop corresponding to the rated making-capacity of any directly associated circuit-breaker or switch. Where in service busbars are protected by fuses or quick-acting circuit-breakers, then the test must be made with these protective devices in operation, as this gives the necessary limitation to current value and also settles the time duration. The tests should be made on an arrangement including a busbar joint and also a connection to the busbar. Consequent upon the introduction of these tests in the new edition, Appendix IV of the 1932 edition has now been omitted.

For a routine test upon busbars, the power frequency test has been specified, this being made either at the manufacturer's works or after erection on site, the relevant values being given in Tables VI and VII.

Several of the appendices given in the 1932 edition have now been deleted, as they are no longer directly relevant. This includes the appendices dealing with the International Standard for the resistance of copper; the effects of internal losses; and the calculation of the mechanical forces due to heavy currents. The tables of current ratings have also been deleted, as the principle of design is now well known and the tables may be misleading as they cannot be applicable to all designs without reference to the arrangement of the bar and the type of insulation and cooling employed.

A new appendix has been introduced dealing with insulation co-ordination, this being similar to the information given for other switchgear items. Another appendix has been introduced dealing with the checking of joints and millivolt drop testing, it being pointed out that resistance measurements are frequently very difficult to take accurately, owing to the low ohmic resistance of joints in busbars rated for large normal currents, and unless great care is taken the values obtained may be unreliable. It is also pointed out that it is extremely difficult to check for slack clamps and bolts by taking resistance measurements, and the best method of checking whether a clamp or bolt is secure is to test the nuts and bolts with a spanner after erection.

TABLE IV.—CLEARANCES FOR ALL OPEN OUTDOOR TYPE BUSBARS OF 22 TO 88 kV RATED VOLTAGE AND FOR OPEN OUTDOOR TYPE BUSBARS FOR NON-EFFECTIVELY EARTHED SYSTEMS OF 110 kV AND ABOVE

1	2	3	4
Impulse voltage withstand level (peak values) (kV)	Rated voltage (kV)	Minimum clearance to earth in air (inches)	Minimum clearance between phases in air (inches)
150	22	11	13
200	33	15	17
250	44	19	22
350	66	27	31
450	88	34	39
550	110	42	48
650	132	50	58
750	165	58	67
1,050	220	82	94

TABLE V.—CLEARANCES FOR OPEN OUTDOOR TYPE BUSBARS FOR USE ON EFFECTIVELY EARTHED SYSTEMS OF 110 kV AND ABOVE

1	2	3	4
Impulse voltage withstand level (peak values) (kV)	Rated voltage (kV)	Minimum clearance to earth in air (inches)	Minimum clearance between phases in air (inches)
450	110	34	39
550	132	42	48
650	165	50	58
900	220	70	81
1,050	275	82	94

TABLE VI.—POWER FREQUENCY TEST VOLTAGES AT MANUFACTURER'S PREMISES

Rated voltage (kV)	Test voltage (kV)
Up to and including	
0·6	2
3·3	9·5
6·6	17
11	27
15	36
22	52
33	76
44	100
66	150

TABLE VII.—POWER FREQUENCY TEST VOLTAGES AFTER ERECTION ON SITE

Rated voltage (kV)	A.C. test voltage (kV)	D.C. test voltage (kV)
Up to		
0·6	2·0	3
3·3	8·6	5
6·6	15·2	10·5
11	24	18
15	32	25
22	46	37·5
33	68	60

The revision is a considerable improvement on the old edition, and by recognising many of the new tests which have been applied to busbars and busbar connections during recent years, the new standard brings the specification of busbars and connections into line with the test and design requirements for associated switchgear.

Electronic Control at a Sugar Factory

A CONTROL installation for continuous diffusers, designed by Evershed & Vignoles, Ltd., in conjunction with the British Sugar Corporation and recently installed at the Corporation's factory at Wissington in Norfolk, is believed to be the first closed loop electronic process control installation applied to the process of extracting sugar from sugar beet in the world.

The installation makes use of a variety of transducers for flow, level, temperature, etc., to provide an electric signal which is either applied to Evershed 3-term process controllers or used as an input to simple analogue computers. Several of these computers, which are completely integrated into the installation, are employed to provide an output signal representing the continuous evaluation of the equation governing the part of the refining process to which they are applied. These computers, in conjunction with the three-term mode of process control, permit extremely fine control of the manufacturing process which will further improve the performance of an already outstanding and up-to-date plant.

The electronic circuitry employed prevents ill-effects caused by possible variations in the power supply, and therefore ensures a stable performance of the installation as a whole.

The graphic control panel, which forms the heart of the whole installation, embodies a number of Evershed miniature recorders that will provide a permanent record of the performance of the plant and will also furnish data for accountancy purposes, etc. The control panel also includes miniplaques, so that bumpless transfer from automatic to manual operation of the plant, when desired, can easily be accomplished. An automatic alarm system, covering every vital part of the plant, also terminates at the panel.

In view of the complexity of the process controlled, use has been made of the "In-Line" Scanner, which facilitates the supervision of the whole of the plant by a single operator, and which pin-points the location of any possible irregularity at once. An interesting feature is the facility with which future extensions of the plant may be added to the present installation and incorporated at the control panel, without interference with the existing control arrangements.

Electrical Contracting Apprenticeship

PROPOSALS BY THE N.F.E.A.

To counter what it describes as totally inaccurate and misleading statements regarding the apprenticeship scheme of the electrical contracting industry the National Federated Electrical Association has prepared a statement in which it makes the following points:—

The present National Apprenticeship agreement in the electrical contracting industry came into operation on 1st September, 1950. It covers, *inter alia*, wages and other conditions of employment and the facilities to be provided for technical education. The agreement, with the full concurrence of the Minister of Works, provided for the "registration" on a national basis of all boys entering the industry, secretarial services being provided by the Ministry of Works operating under the ægis of an Apprenticeship and Training Council.

Some two years ago the Minister of Works intimated that he was no longer willing to provide the secretarial services. As a result of discussion, certain rearrangements were made by which the Ministry still undertook the work involved until 30th November, 1957, when the "registration" services were finally withdrawn.

The N.F.E.A. came to the conclusion that registration in itself served no useful purpose, but nonetheless it was anxious for the Apprenticeship and Training Council to continue to operate with the independent services of Sir George Gater as chairman. The Electrical Trades Union, on the other hand, desired to continue a scheme of registration and only on that basis were they willing to continue to contribute towards the cost of operating the Apprenticeship and Training Council.

Craft and Technical Categories

Early in 1956 the N.F.E.A. decided to examine the apprenticeship scheme as operated over the preceding five years and came to the conclusion that certain alterations were justified in the interests of the industry and the public; it was of the opinion that the present scheme was wasteful and failed to serve its purpose because a high proportion of boys could not or would not benefit from the technical studies which they were required to undertake. It put forward a scheme by which apprentices should be divided into two categories:—Craft apprentices and technical apprentices. The scheme envisaged payment of extra rates to boys who were successful in passing the City and Guilds "Course B" examination.

The proposals of the N.F.E.A. were submitted to the E.T.U. on 27th February, 1957, and thereafter were pursued at a meeting of the Standing Committee of the National Joint Industrial Council for the Electrical Contracting Industry, held on 6th March, 1957, when it was finally agreed that the E.T.U. would conduct a detailed examination of the N.F.E.A. proposals. At the next meeting of the Standing Committee held on 29th August, after a lengthy discussion, the E.T.U. stated that the whole question would receive the Union's careful consideration and a full reply would be given to the N.F.E.A.

At the annual meeting of the N.J.I.C. on 5th November the E.T.U. stated that they were still examining the N.F.E.A. proposals and would report in writing at the earliest possible moment. The N.F.E.A. expressed their anxiety to have a practical and realistic scheme ready to supersede the one due to terminate in March, 1958. The existing national agreement provides that it may be amended or terminated subject to six months' notice from either side, expiring in March or September of each year. The N.F.E.A. gave such notice to expire at the end of March, 1958, assuming that six months from the end of September, 1957, would be amply sufficient to negotiate a new agreement.

The N.F.E.A. affirm that they have no intention whatsoever of terminating the engagement of apprentices in the industry as erroneously stated in one of the national newspapers. Equally they have no intention of withdrawing adequate facilities for apprentices to attend technical classes provided that they are capable and willing to absorb tuition. Indeed, in the proposals put forward by the N.F.E.A. daytime release to attend classes would be extended in the case of technical apprentices to the age of 19 years, against 18 years as at present.

Recruitment Rate too Low

An appendix to the statement says that many N.F.E.A. members complain that many boys entering the industry are incapable of profiting from the training facilities offered by the scheme. The present recruitment rate is too low and steps should be taken to enable the best lads to be retained in the industry, which continues to need the services of highly-trained technicians as well as good practical craftsmen.

After tests in basic subjects all boys should be given several opportunities of passing the preliminary examination of "Course B" of the City and Guilds of London Institute. Boys who fail to pass the preliminary examination by the time they are 17½ years of age should remain in the "craft" classification and no day-release educational facilities should be afforded to them. Those passing the examination should be allowed the educational facilities at present laid down in the scheme with an extension to allow for day releases up to the age of 19 years. These boys would be in the "journeyman" classification, but continuance of the day-release facilities should be dependent upon their passing the annual course examinations. It is proposed that boys passing the "Course B" examination should receive extra weekly payments up to the end of their apprenticeships, i.e. at the age of 21.

At the termination of apprenticeships both craftsmen and technicians should receive the same rate of pay, but employers, under the National Working Rules, have discretion to reward merit—practical or otherwise.

If these principles are accepted it will be necessary to undertake investigations into the means by which the preliminary examination in the basic subjects and the simple technical course can be organised at technical schools throughout the country. It would then be necessary to obtain the E.T.U.'s agreement to the proposed changes in the apprenticeship scheme. It is suggested that the Ministry of Education should be asked for statistics showing the number of boys who fail to pass the first-year examination of the City and Guilds "Course B"; such statistics would lend considerable force to the Association's contention that the present scheme is wasteful in insisting upon technical education by day release for lads who cannot benefit from it.

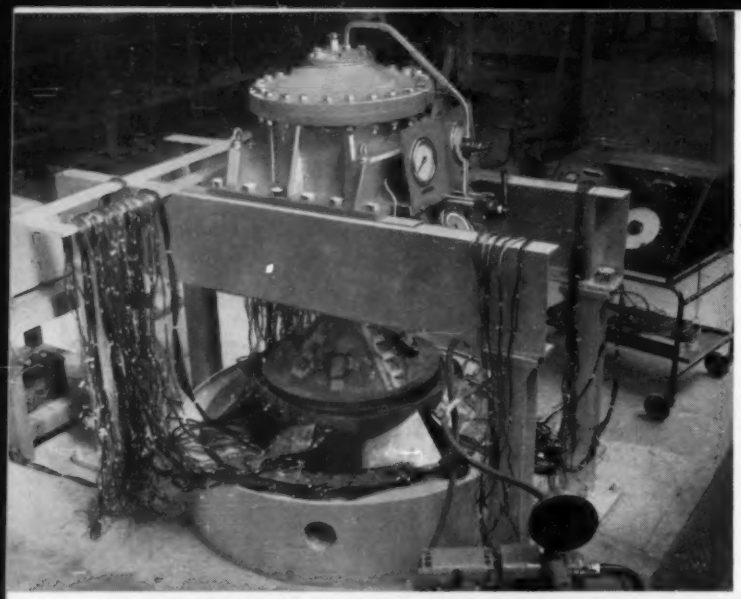


Fig. 1.—Resistance strain gauges used in hydrostatic pressure testing. (English Electric Co., Ltd.)

Survey of Applications in Measurement, Control, Data Handling and Processing

By G. M. ETTINGER*

Electronics in Heavy Industry

NOT many years ago the use of electronics in heavy engineering was limited to simple temperature indicators and to the control of the smallest electric motors. In recent times, however, new developments in electronic measuring and control techniques, coupled with more limited uses of high power electronic processing equipment, have kept pace with the increasingly stringent requirements of modern industry.

The use of transistors, which were first disclosed in 1948, has led to greatly improved reliability of electronic controls, allied with substantial reduction of power and space requirements. This has led to the gradual acceptance of electronics in closed loop control systems. Instead of merely measuring a physical quantity, reliable installations can now be designed to measure, compare with a computed optimum and ensure that the manufacturing processes are modified to make an end product to the desired limits.

This article compares some features of analogue methods of measurement and process control with those of digital methods, which are already finding increasing uses in the chemical industry. Digital techniques, of course, can lead to much improved accuracy. No more than a brief survey of the wide field of electronics in heavy industry can be attempted here. No attempt is made to describe complete "automated" installations, but specific techniques and instruments are mentioned and their fields of application considered.

Measuring techniques and transducers are first discussed. These, of course, form the basis of more advanced applications such as automatic inspection, process control and specialised techniques employing radio-isotopes which have become vital tools in engineering research.

Various acoustic methods for flaw detection are described; these may be used to produce visual displays of the sound intensity transmitted through engineering components and offer a rapid means of flaw detection.

Finally, analogue and digital computers are discussed. Digital machines may be used not only in the solution of specific engineering problems but as data handling systems. Clearly, the mere possession of even the most advanced machine tools, however well fitted with automatic controls, will not ensure efficiency unless they are backed by effective ancillary services such as production planning, cost control and stock recording. It is in these fields that electronic data handling can play an important part.

All forms of engineering depend on measurements. These range from the older requirements for measuring merely quantities such as length, weight or temperature to modern applications of spectrographic and X-ray analysis, pH control, micro-displacement and the like. Electronic measuring means for non-electrical quantities usually comprise a transducer, means for transmitting its signal to a measuring point and an indicator or recorder. Electronics are widely used to facilitate remote reading (telemetry). Whereas a thermometer may be adequate to read the temperature of a process, conversion to an electric signal is necessary if the information is to be transmitted over appreciable distances. Similarly, an operator can check items going slowly along a conveyor but it may be more convenient to have remote indication, at a central monitoring or control point, of the quantities flowing on a number of lines.

Fig. 2.—"Dekatron" counting and indicating tube. (Ericsson Telephones, Ltd.)

Conventional electronic measuring and transmitting instruments may be expected to have long-term accuracies of a few per cent of full scale reading. As processes become more critical, such accuracies tend to become insufficient. They can be greatly improved by digital means. Thus, the movement of a pressure-transmitting element (as used in liquid level control for example) can be converted

* Marconi Instruments, Ltd.

into digital information (presence or absence of pulses on a number of wires or, serially, on a single wire at given time intervals). Digital techniques are finding favour for process control in the United States.

Transducers for converting physical quantities into electric signals may be a.c. or d.c. operated. Frequencies are usually 50 or 400 c/s. Voltages normally range from 12 to 250, that most frequently used in industrial applications being 110 V. Much higher frequencies are needed for capacitance type pressure and displacement gauges. Transducers may act by variation of electric impedance (resistance strain gauges or variation of self or mutual inductance), or by generation of an electric analogue to the physical quantity (voltage from an electrostrictive crystal under load, voltage induced in a pickup coil by movement relative to a magnet or the small voltage measured in pH determinations). The ratio of several voltages can be varied by the quantity being measured, as in position transmitters of the "selsyn" or "desyn" type. The possible greater reliability of self-generating transducers, which require no external power supplies, has to be balanced against the greater accuracy of variable impedance transducers.

Position Measurement

A basic device for displacement measuring applications is the resistance strain gauge. It is simple in construction and can be applied to measure small dimensional changes, as in the testing of tensile specimens, in the measurement of forces and weights and, of course, in the strain testing of complete structures. In these applications electronic equipment is used merely to amplify the strain gauge circuit output. Fig. 1 shows a speed ring for a model water turbine undergoing hydrostatic pressure tests. Strains are measured by a large number of strain gauge bridge circuits which are successively switched to a single amplifier.

For the measurement of minute displacements, electro-pneumatic systems[1] have advantages. A typical system may comprise a nozzle which is partially blocked when a lever is slightly displaced. The increase of pressure behind the obstructed nozzle may be used to operate an electric switch and, in self-balancing systems, to move the nozzle so as to restore the pressure to its original value.

In the measurement of larger displacements, the sliding contact d.c. potentiometer is gradually being displaced by "selsyn" type instruments and by differential transformers. These instruments, being effectively ratiometers, have the advantage that variation of supply voltage has little effect on indication.

Pressure Transducers

These form an important link in many chemical and industrial processes. Variation of capacitance due to deformation of a diaphragm under pressure has been employed to vary the tuning of resonant circuits. The amount of retuning required gives a measure of the static pressure; for dynamic measurements the output of a frequency demodulator can be rectified so that very rapid pressure fluctuations can be displayed. In another system strain gauges are employed to measure deflection of a diaphragm under pressure. Pressure measurement is, of course, also needed to determine liquid levels, and various load cells using strain gauges, variable inductances or variable resistances are employed, sometimes in preference to expensive float and rheostat installations.

Measurement of Speed

Speed measurement is an important requirement in engineering testing. For example, efficiency tests on large machines, however precise the torque measurements, can never be more accurate than the measurement of speed. Mechanical tachometers have limited accuracy and, moreover, must be mounted relatively near the rotating shaft. Other means of measuring speed include d.c. and a.c. tachometric systems where the output of a small generator (rectified if necessary) is applied to a voltmeter. These systems are widely used in industry and transport and give good accuracy. In the precision testing of machines, electronic speed measuring devices have found many uses. These rely essentially on a total revolutions counter, frequently using pulse amplifiers followed by neon counting tubes or other electronic indicating means connected to high precision timing circuits. A 10-electrode neon counting and indicating tube is shown in Fig. 2. Instead of instantaneous speed of rotation, this method gives very precisely the number of revolutions in a given time. Accuracy of speed

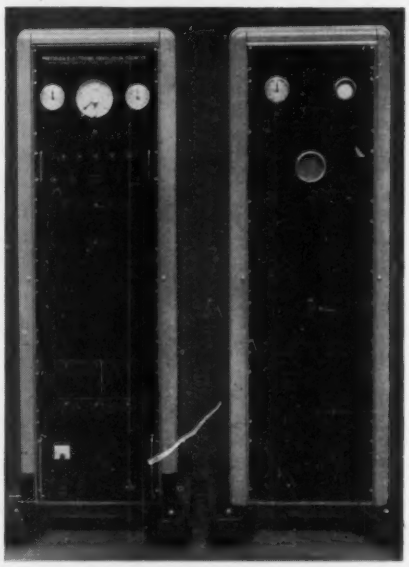


Fig. 3.—Electronic revolution counter. (English Electric Co.) Left-hand rack contains timer and five-decade counter; right-hand rack houses standard frequency source

measurement depends essentially on an exact knowledge of elapsed time; measurement with errors smaller than 0·01 per cent of mean speed can readily be achieved.

Fig. 3 shows electronic counting and timing equipment in use for the efficiency testing of model turbines. It is an advantage of electronic speed measuring techniques that no conventional tacho-generators are required. Speed signals can be obtained from light magnetic pickups or from perforated discs interrupting light to a photo-cell one or more times per shaft revolution.

Finally, stroboscopic methods may be considered for speed measurement. These are, of course, extremely simple and require no attachment to the machine on test. Accuracy of speed measurements obtained by stroboscopic means depend largely on the precision with which the repetition rate of light flashes can be set and read.

Temperature Measurement

Two main electrical methods of temperature measurement are in use. These are based on resistance thermometer bridges and on thermocouples. Direct reading on millivoltmeter or ratiometer instruments is possible

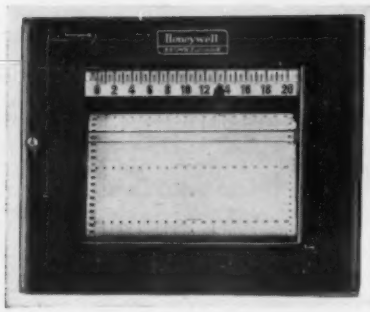


Fig. 4.—Precision multi-point temperature recorder. (Honeywell-Brown, Ltd.)

but, frequently, electronic amplifiers are employed to obtain electric signals at a power level high enough to drive recorders or large indicators. Transistor amplifiers are finding uses in thermocouple voltage measurements and, for the indication of temperatures at many points, manual or automatic cycling from one thermocouple to another is employed.

The majority of precision temperature controllers employ electronic amplification. Fig. 4 shows a typical recorder and controller which operates an electric power circuit in response to temperature changes as small as 0·05 deg C. Very precise temperature control can also be achieved by employing photo-electric cells or photo-multipliers which operate a relay when a light beam is obscured by the column of a mercury thermometer.

Torque Measurement

In the testing of small machines, torque may be measured by noting the reaction between a pivoted stator and a fixed reference. This measurement can be conveniently carried out by strain gauge load cells which measure the bending strain in a cantilevered loading beam.[2] Amplifiers are used in the measurement to raise the strain gauge current unbalance to a power level which can be applied to robust indicating instruments.

Torque may also be found by measuring the torsion of a load-carrying shaft. This measurement may be carried out, for example, by mounting a magnetic coil assembly on the rotating shaft, with the magnetic circuit almost completed by another magnetic member fixed some distance along the shaft. Torsion produces relative angular displacement of the two magnetic members, so that the self-inductance of the coil changes slightly. This change unbalances a bridge circuit whose output is amplified, rectified and applied to a meter. Field and Towns[17] have measured torsion of high-speed shafts by a photo-electric method to obtain torque readings to an accuracy of $\pm 0{\cdot}25$ per cent.

Information Transmission

Signals from electric transducers are, of course, transmitted through individual wires over reasonable distances within an engineering plant. For greater distances, information from many instruments can be sent over a single pair of wires by time-sharing techniques or by frequency sharing, such that information from each instrument modulates a different sub-carrier. Digital presentation of the information as the presence or absence of pulses may be employed in such applications. Digital information is well suited to the planning of complex processes. Fig. 5 shows a simple analogue-digital encoder[3] which translates shaft rotation, such as the movement of the pointer of a pressure gauge, into a desired digital code. In such continuous applications the well-known binary code has certain disadvantages which are overcome by codes where one quantum increment of analogue information causes a change of only one digit and therefore avoids discontinuities.

The results of process measurements must often be recorded, either for future reference or to give visual indication of trends. (This last requirement is really just that of differentiation which can be met by other means.) Recorders of very many types are employed in industry; where possible the input quantity is made to operate a stylus directly, without transducers. Pressures, flows and speeds of rotation can be arranged to move recorder styli by mechanical means. However, for the recording of rapidly varying quantities, electric recorders have advantages. Recorders used in engineering research usually have synchronous electric chart drives and adjustable gain signal amplifiers. Ink writing recorders can be made sensitive to input powers as small as a few milliwatts. They are used up to frequencies of about 100 c/s. One advantage of high electronic power amplification is, of course, that the transducer controls very little power and can, therefore, be light and have fast response. For the recording of phenomena at rather higher subsonic frequencies, spark writing recorders are sometimes employed. These, requiring no ink system, can have extremely light movements, hence have better frequency response.

For rapidly changing physical phenomena cathode-ray tube photography is employed. This method has great sensitivity and, of course, negligible lag beyond that associated with the basic transducer. Multi-gun cathode-ray tubes are available to record simultaneously a large number of variables. More signal channels are obtained by beam switching, such that the beam from a single electron gun is periodically deflected and switched to different inputs, or by employing a large number of

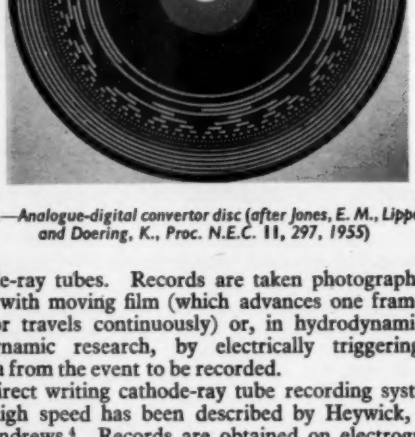


Fig. 5.—Analogue-digital convertor disc (after Jones, E. M., Lippel, B., and Doering, K., Proc. N.E.C. 11, 297, 1955)

cathode-ray tubes. Records are taken photographically, either with moving film (which advances one frame at a time or travels continuously) or, in hydrodynamic and aerodynamic research, by electrically triggering the camera from the event to be recorded.

A direct writing cathode-ray tube recording system of very high speed has been described by Heywick, Wohl and Andrews.[4] Records are obtained on electrographic paper in contact with a row of targets to which current is supplied by the electron beam of a special cathode-ray tube.

For the recording of very brief transients, mechanical

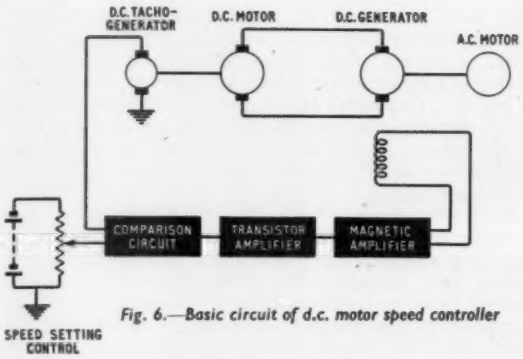


Fig. 6.—Basic circuit of d.c. motor speed controller

shutters on conventional cameras may be too slow. Hence Kerr cells,[5] whose action depends on the rotation of the plane of polarisation of light in liquid media such as nitrobenzene under the action of electric fields, are employed. The necessary potentials (of the order of 50 kV) are generated by thyratron-controlled discharge of condensers through pulse networks. Photographic exposure times of the order of 0·1 microsec have been obtained by this means.

Speed Control

Important applications for electronic controls are found in the speed regulation of electric motors. Smooth variation of speed can, of course, be obtained by Ward-Leonard control or variable frequency supplies and electronics (or magnetic amplifiers) are often used to obtain precise speed regulation in spite of varying load or varying supply voltage. A basic arrangement for electronic speed control, which may be applied to d.c. motors up to some hundreds of horse power, is shown in Fig. 6. A permanent magnet tacho-generator is used to produce a signal proportional to speed; this signal is compared with a d.c. reference voltage, often from an electronically stabilised voltage source. The difference is amplified (transistors are preferably used, at least in power levels up to some watts) and applied to the armature of the controlled motor. Where appreciable power is to be controlled, the final stage of amplification may take the form of a motor-driven d.c. generator. Motor speed control to one part in some thousands is possible with simple electronic equipment. Fast response can be obtained by arranging the amplifying circuits to supply reverse current for forced braking. Applications for high precision speed controls of this form are found in the testing of rotating machines, in the calibration of prime mover controllers, and in critical speed testing.

Greater precision of speed control is possible by using as the feedback signal not a voltage approximately proportional to speed, but a signal containing frequency information. Thus, a.c. of a frequency proportional to speed may be generated by a low power alternator coupled to the controlled machine, and frequency sensitive or frequency comparison circuits may be employed to produce error signals which are applied to servo amplifiers. Such systems employ L-C or parallel-T circuits.

Inspection

Modern engineering materials and components require inspection procedures going far beyond visual dimensional checks. Several methods are available for the detection of internal cracks, blowholes, voids and the like in metal components. One method, which is especially suited to the comparison of large quantities of identical components, employs magnetic induction, with exciting and pickup coils in close proximity to the component under inspection. Large cracks disturb the magnetic flux pattern and hence affect inductance and magnetic losses which can be measured by simple bridge circuits.

Acoustic inspection methods[6] are capable of very good resolution. Several techniques are used, relying on the transmission of continuous or pulsed sound, usually in the supersonic or ultrasonic range (10 kc/s to 500 kc/s). Any void in the path of the sound beam (which is applied by quartz or other electrostrictive transducers or by magnetostrictive means) causes reflection, hence reduced transmission of acoustic energy to a pickup located at the far side of the component. A similar technique relies solely on the reflection of sound energy for the detection of changes of acoustic impedance in engineering components. Suitable choice of frequency permits high resolution for the detection of fairly small discontinuities. Both the distance from the surface and the approximate extent of the discontinuity can be determined from oscilloscopic presentation.

Another acoustic method, due to Pohlmann,[7] again depends on sound transmission. Instead of using a transducer to measure transmission at a particular point, the pattern of transmitted energy over the whole component is displayed optically as a result of the selective alignment of small particles suspended in liquid in a light and sound transparent cell. Petermann and Oncley[8] have displayed acoustic energy patterns on phosphorescent screens; their method is especially useful for the study of acoustic fields in the megacycle range.

Electronic Power Applications

Electronics have invaded the material processing field itself. Eddy current heating has been in use for some years. Operation at mains frequency eliminates the need for electronics. Operation at the lower audio frequencies is possible with the use of high-frequency alternators but, to ensure the slight penetration needed for surface hardening, high-frequency vacuum tube power generators may be used. Dielectric heaters at powers up to some tens of kilowatts are used for the heating and curing of wood and plastics, for soldering and brazing operations and of course for the annealing of engineering components. A high power r.f. heating installation is shown in Fig. 7.

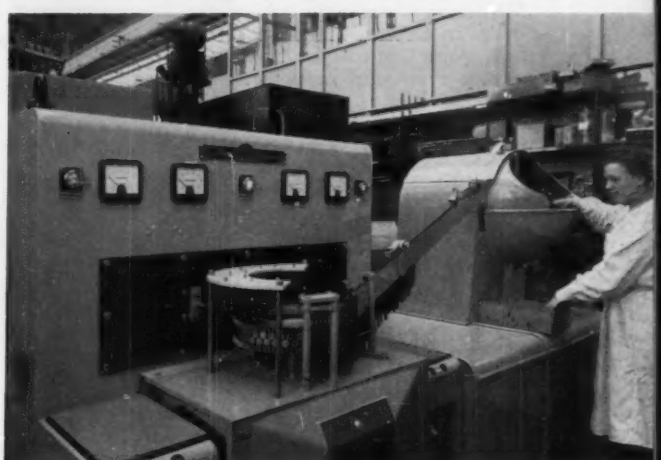


Fig. 7.—5 kW induction heater with automatic feed equipment for the annealing of starter bolt heads. (English Electric Co., Ltd.)

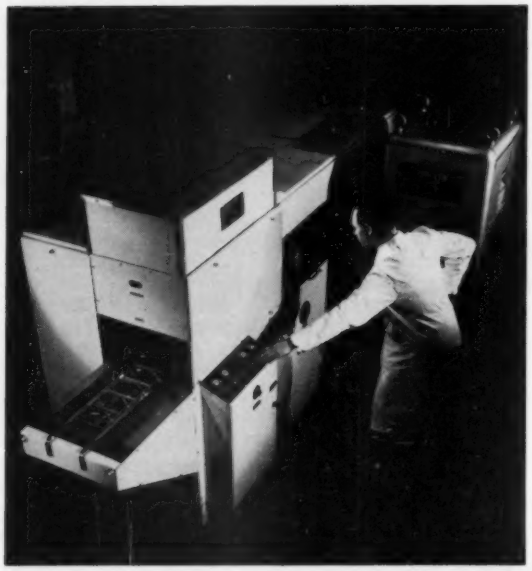


Fig. 8.—High-power conveyor type ultrasonic cleaning equipment incorporating a Mullard transducer system and generator (Kerry's)

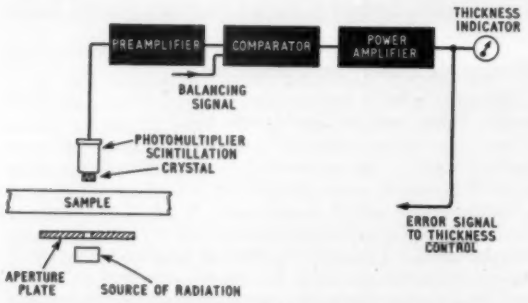


Fig. 9.—Basic arrangement for thickness gauging by radiation absorption

Machining of materials such as ceramics, glass, quartz or tungsten carbide, which are considered too hard for cutting by conventional machine tools, has become practicable as a result of developments in ultrasonic power techniques,[9] where a tool of arbitrary cross-section is caused to vibrate a fine slurry of abrasive material against the work. Material is removed by a process of cavitation or erosion; the holes cut by this method reproduce faithfully the shape of the vibrating tool. Frequencies of the order of 30 kc/s are employed; the power (usually converted by magnetostrictive transducers) ranges from 50 W to several kW.

Acoustic energy at high power levels is also used to degrease and clean engineering parts, transducers of the magnetostrictive or electrostrictive type being employed to set up standing waves in a liquid, which remove surface contaminants by cavitation action. A high power ultrasonic degreasing installation used for the cleaning of large numbers of precision components is shown in Fig. 8.

Nucleonics

Radio-isotopes are widely used in testing and research. Gamma-ray thickness gauges, which have the advantages over X-ray gauges of compactness and economy, require very sensitive detecting and amplifying circuits to translate minute changes of radiation transmission into meter or recorder deflections. The general principle of thickness gauging by radiation absorption[10] is indicated in Fig. 9. This figure shows a metal strip under test, a source of gamma rays on one side and a radiation detector on the other. As the strip moves relative to the source and detector, small changes of thickness produce changes of detector output.

Radiation detectors for industrial inspection are normally of the scintillation counter-photomultiplier type (Fig. 10) or of the photoconductive type.[11] In the former case radiation-induced fluorescence in organic crystals (such as sodium iodide or potassium iodide) is guided to the photocathode of secondary emission multipliers which can detect illuminations of less than 10^{-10} lumens. By means of successive amplification at a number of secondary emission multiplying surfaces (giving a total electron multiplication of several millions) a current substantially proportional to incident radiation is established at the final anode of the photomultiplier. This current is further amplified by vacuum tubes, transistors, or magnetic amplifiers, compared with a reference current and indicated or recorded. With the equipment set up to give zero output when the material under inspection is of the correct thickness, variations of thickness or density produce output unbalance.

An alternative method employs photoconductive radiation detectors (typically cadmium sulphide or cadmium selenide) whose resistance changes when they are exposed to gamma rays. The output of a simple bridge circuit containing one or more photoconductive crystals can be used to operate thickness indicators.

A further important application for tracer techniques, again relying on electronic amplification, is found in the study of impurity absorption and surface wear. A "labelled" impurity can be added at one stage of a metallurgical process and quantitatively identified at a later stage by radiation detectors of the types already mentioned or by means of Geiger-Müller counters or ionisation chambers.

Industrial television may be used for the remote reading of a number of instruments. Another application lies in the general monitoring of installations which cannot be safely approached. Examples are observations within the shell of a nuclear reactor and the monitoring of furnace conditions. A stereoscopic television installation[12] has been described, which uses two camera channels and two kinescopes whose images are passed through mutually perpendicular polaroid filters and optically superposed.

Special television camera tubes have been developed for industrial television applications. These permit simpler circuitry, lower operating voltages and reduced dimensions. Camera tubes whose diameter is less than one inch are available. For industrial television, where information may have to be passed along ordinary wire pairs or over short lengths of telephone wires, scanning frequencies may be lower than in conventional broadcast television. Availability of transistors is expected to lead to greatly increased uses of industrial television.

Computers

Computers and simulators are already firmly established in industry. Electronic analogue computers are used in the development and testing of many engineering products, both prime movers and ancillaries. As an early example may be quoted a.c. network analysers which have contributed to economic development of large power transmission systems. Electronic heat flow simulators have been constructed; an instrument of this form, based

Fig. 10.—Photomultiplier-scintillation crystal radiation detector. (Standard Electronic Research Corp., New York)

on the techniques of Liebmann,[13] is shown in Fig. 11. This serves to compute time and space distribution of temperature in structures consisting of materials having different thermal properties.

In the development of prime mover ancillaries, estimates of performance can be approached by testing items such as speed or load controllers in conjunction with simulators rather than with large prime movers. Savings in power consumption and cost are realised in this way. Electronic simulators have been employed to compute the performance of aircraft engines over wide ranges of temperature, pressure and power.[14] Many engineering problems which can be represented by differential equations with constant or non-constant coefficients are conveniently solved on analogue computers.

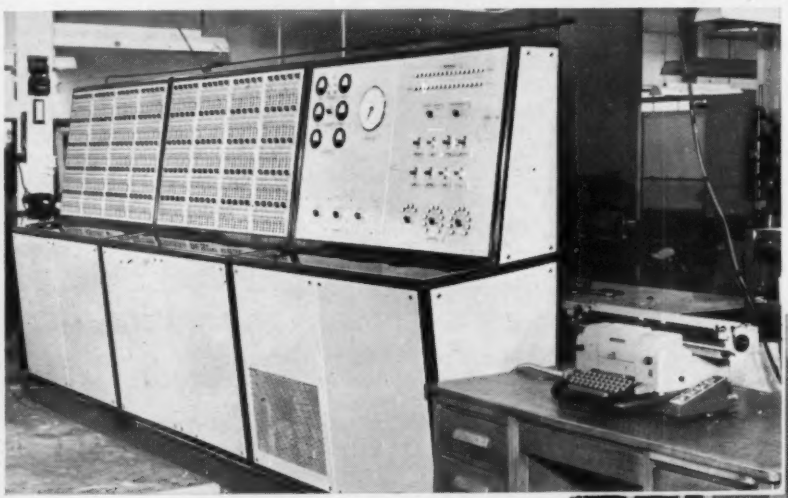
Digital computers are used to solve a wide range of engineering equations involved in the design of structures. A "DEUCE" digital computer is shown in Fig. 12. In the United States about 600 large digital computers are in operation.[15] Present research in the digital field is directed to increases of speed of operation, reduction of access time and to simplification of construction. Many recent advances have been based on circuits using magnetic core memory "matrices."

Data handling, both in research and development and in production and long-term planning, has become an important section of the electronic industry. In the first of these applications, the results of large-scale laboratory tests which have in the past required numerous observers plotting many graphs, can now be fed directly to analogue-digital convertors. Digital output is recorded on punched cards, tape or in magnetic memory systems; computations are performed and the final result which may represent, for example, an optimum pressure, an efficiency, or the yield of a chemical process, may be reconverted into analogue form.

Data handling equipment for chemical processing has been developed to the stage where complex series of operations may be planned and set up on digital equipment;[16] differences between the planned programme (whose time scale is controlled from a master pulse generator) and actual performance result in the operation of servo-mechanisms which control processes through electro-hydraulic or electro-pneumatic valves. It is likely that digital programming and process control techniques will find increasing uses in industry.

BIBLIOGRAPHY

1. Molle, R. "Automation à l'Aide de Circuits Pneumo-Electriques et Pneumo-Hydrauliques." (Paper presented at International Congress on Cybernetics, Namur (June, 1956).
2. Instrument Society of America Journal, **3**, 166A (September, 1956).
3. Bower, G. G. *Control Engineering*, **4**, 107 (April, 1957).
4. Heynick, L. N., Wohl, J., and Andrews, D. M. Proceedings of the National Electronics Conference, **11**, 172 (1955).
5. Nicholson, W. Q., and Ross, I. *Electronics*, **28**, 171 (June, 1955).
6. Mattiat, O. Proceedings of the National Electronics Conference, **9**, 224 (1953).
7. Pohlmann, R. *Technik*, **3**, 465 (1948).
8. Petermann, L. A., and Oncley, P. B. Proceedings of the National Electronics Conference, **11**, 481 (1955).
9. Hartley, M. S. *Electronics*, **29**, 132 (January, 1956).
10. Ettinger, G. M. *Electronics*, **26**, 142 (April, 1953).
11. Jacobs, J. E. *Electrical Engineering*, **70**, 667 (1951).
12. *Electronic Engineering*, **21**, 191 (April, 1957).
13. *Engineering*, **183**, 343 (1957).
14. *Electrical Engineering*, **75**, 659 (1956).
15. McNeill, R. B. "Electronic Data Processing in Industry," p. 231. (New York, American Management Association.)
16. Kessel, B., and Brooks, R. W. Transactions of the Institute of Radio Engineers, **PG.1-5**, 79 (June, 1956).
17. Field, V. F., and Towns, D. H. *Electronic Engineering*, **26**, 486 and 529, 1954.



Left: Fig. 11.—Liebmann type heat flow computer. (Sunvic Controls, Ltd.)

Below: Fig. 12.—English Electric "Deuce" high speed digital computer in operation at the Mathematical Services Establishment, Bristol Aircraft, Ltd.

European Common Market Countries

INTERCHANGE OF ELECTRICAL TRADE

To assist in discussions on the relationship between the United Kingdom and the Common Market countries we have compiled some comparative statistics showing the output of the electrical manufacturing industries in the United Kingdom and the six member countries of the Common Market and of the trade in electrical goods both between the individual members and with the United Kingdom.

The Treaty of Rome, which was signed by Western Germany, France, Italy, the Netherlands, Belgium and Luxembourg on 25th March, 1957, provides for the gradual establishment of a European Economic Community in a period of twelve to fifteen years beginning on 1st January, 1958. The six member countries will form a single market surrounded by a single import tariff and they will increasingly tend to act as one country in their commercial dealings with the rest of the world.

On the basis of the 1955 figures, the Common Market countries form the world's second largest trading community, with a total combined export trade, excluding trade between themselves, valued at £4,500 million. In the same year the total exports of the United States were

TABLE 1.—TOTAL ELECTRICAL PRODUCTION, IMPORTS AND EXPORTS—U.K. AND COMMON MARKET COUNTRIES
(£ million)

Exporting Countries	Year	Production	World Exports	% Production Exported	Total C.M.	Bel./Lux.	France	Neth.	Italy	W. Ger.	U.K.
Belgium/Lux.	1954	69	22·7	33	10·9	—	1·1	9·3	0·2	0·3	0·3
	1955	80	29·2	37	14·5	—	1·6	12·0	0·4	0·5	0·3
	1956	—	35·1	—	16·8	—	1·4	14·5	0·2	0·7	0·4
France	1954	415	45·8	9	6·3	2·7	—	2·0	0·7	0·9	0·6
	1955	550	51·2	10	8·3	2·9	—	2·7	1·7	1·0	0·8
	1956	—	48·4	—	6·5	2·3	—	1·9	1·3	1·0	0·7
Netherlands	1954	107	56·5	55	16·3	7·6	2·2	—	1·9	4·6	4·7
	1955	135	65·3	50	18·9	8·7	2·9	—	1·7	5·6	6·1
	1956	—	66·1	—	21·1	9·5	3·5	—	2·1	6·0	3·7
Italy	1954	132	14·1	10	4·0	0·7	2·3	0·7	—	0·3	0·2
	1955	141	16·1	11	3·0	0·4	1·2	0·6	—	0·8	0·3
	1956	—	15·2	—	3·2	0·4	1·2	0·8	—	0·8	0·5
West Germany	1954	730	132·1	18	35·2	8·5	5·9	13·5	7·3	—	1·9
	1955	891	162·2	18	43·5	9·5	7·1	18·5	8·4	—	4·5
	1956	—	195·1	—	59·0	12·5	9·9	24·3	12·3	—	3·9
Total C.M.	1954	1,453	271·2	19	72·7	19·5	11·5	25·5	10·1	6·1	7·7
	1955	1,797	324·0	18	88·2	21·5	12·8	33·8	12·2	7·9	12·0
	1956	—	359·9	—	106·6	24·7	16·0	41·5	15·9	8·5	9·2
United Kingdom	1954	1,000	170·2	17	15·9	3·0	3·1	6·5	2·7	1·6	—
	1955	1,174	191·8	16	17·9	3·0	3·1	6·8	2·9	2·1	—
	1956	—	217·2	—	21·5	3·5	4·2	8·2	3·4	2·2	—

TABLE 2.—IMPORTS AND EXPORTS OF FIVE PRINCIPAL GROUPS IN 1956
(£000)

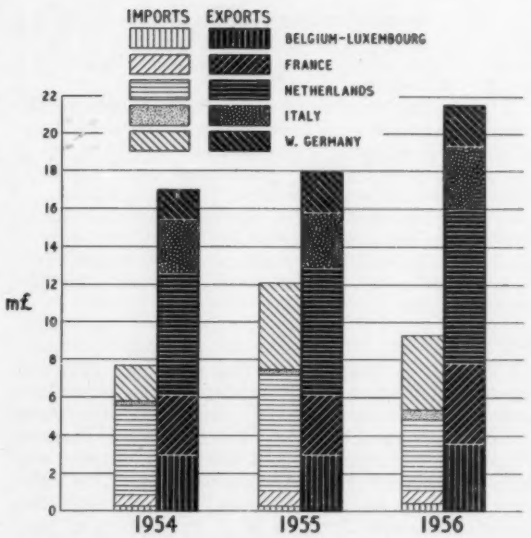
Product	Importing Countries	Bel./Lux.	France	Neth.	Italy	W. Germany	U.K.
Motors and Generators ...	Bel./Lux....	—	185	537	2	2,005	272
	France	172	—	229	362	466	205
	Netherlands	992	260	—	11	2,223	1,194
	Italy	32	341	11	—	597	129
	W. Germany	104	21	79	10	—	232
	United Kingdom	107	63	64	5	300	—
Transformers	Bel./Lux.	—	71	166	n.a.	145	11
	France	200	—	10	161	39	6
	Netherlands	683	251	—	8	540	66
	Italy	24	91	n.a.	—	252	6
	W. Germany	30	8	90	6	—	2
	United Kingdom	5	8	30	2	129	—
Switchgear	Bel./Lux.	—	400	623	13	850	117
	France	51	—	319	n.a.	186	21
	Netherlands	839	540	—	41	950	224
	Italy	n.a.	14	196	—	601	22
	W. Germany	9	36	30	9	—	11
	United Kingdom	20	10	50	2	68	—
Radio and T.V.	Bel./Lux.	—	196	2,040	17	2,523	866
	France	192	—	1,875	544	760	1,930
	Netherlands	9,505	439	—	609	5,011	2,602
	Italy	n.a.	358	458	—	3,040	1,372
	W. Germany	8	26	318	12	—	915
	United Kingdom	59	379	2,302	188	1,751	—
Domestic Appliances (Excl. Refrigerators)	Bel./Lux.	—	39	623	12	2,637	447
	France	87	—	319	43	407	116
	Netherlands	368	37	—	79	3,386	505
	Italy	11	29	198	—	1,724	169
	W. Germany	98	7	322	15	—	334
	United Kingdom	81	11	335	161	534	—

n.a. = not available

£5,500 million and those of the United Kingdom £2,900 million. Exports of electrical goods followed the same pattern and in 1955 were: the United States, £302 million; the Common Market countries, £235·8 million; and the United Kingdom £191·8 million.

Although there has been a steady increase in British electrical exports to the C.M. countries, these countries, being themselves producers, do not make a very large call on the resources of British electrical manufacturers. The £17·9 million exported to the C.M. countries in 1955 represented 9·4 per cent of total exports as compared with 9·7 per cent sent to other O.E.E.C. countries and 54·3 per cent to the Commonwealth. However, as is pointed out in *Britain and Europe*,* intra-European trade is growing more rapidly than Britain's trade with the Commonwealth, and is likely to be further stimulated by the present measures for integration. The internal trade of the C.M. countries represented 28·5 per cent of their total combined electrical exports.

As can be seen from Table 1 the Netherlands was not only the largest market for British manufacturers but also the largest importer of goods from the other members of the Common Market. Germany's dominant position as a producer and exporter is also brought out, although both Belgium/Luxembourg and the Netherlands exported a larger proportion of their total output. The significance of the French home market and the fact that nearly half the Belgian exports during the last three years have gone to other C.M. countries, will also be noted. The analysis in Table 2 of the trade in five principal classes of product shows the importance of the United Kingdom's exports of radio and television equipment.



The United Kingdom's trade with the Common Market countries

* See *Electrical Review*, 13th December, p. 1089.

Electrical Research Reports

AMONG the latest publications to be issued by the British Electrical and Allied Industries Research Association, Ref. S/T80, "Developments in E.R.A. Impulse Testing Technique," by J. L. Miller, Ph.D., A.M.I.E.E., and E. M. Dembinski, Dipl.Ing. (12s 6d), describes novel trigger-gap and triggering circuits which have been developed for the "controlled" operation of a twelve-stage surge generator. Triggering can be effected automatically or by hand with a high degree of consistency. The arrangement also permits the output voltage of the impulse generator to be varied within a wide range without altering the setting of the generator gaps. Modifications have been introduced in the impulse generator, the capacitive potential divider, and the recording equipment. These modifications have resulted in waveshapes being recorded which are free from disturbances.

Transformer Tests

Many investigations have been made by the E.R.A., and others, to determine the worst conditions which can occur within transformer windings as the result of single surges applied to line terminals. (See reports Refs. S/T2, S/T4, S/T19, S/T34, S/T35, S/T43, S/T48, S/T55.) Some attention has been paid to the effects of single chopped waves but, so far, the possible effect of a series of such surges does not appear to have been investigated, possibly because the generation of suitable waves with controlled parameters presents considerable difficulty.

In Ref. S/T73, "Surge Voltage Distribution in Transformer Windings due to Current Chopping," by E. L. White, B.Sc.(Eng.), A.M.I.E.E. (12s), a method of generating a controlled series of chopped surges is described and the voltages produced by such a series within a transformer winding are given, with particular reference to the worst possible conditions which can be obtained by varying the time interval between surges. The report is hypothetical in the sense that it does not purport to deal with the question of whether, and if so by what mechanism, recurrent surges of the type investigated can occur in practice.

Voltage Stabilisers

Ref. V/T130, "Electronic Voltage Stabilisers for Laboratories, Computers and Control Systems," by J. Miedzinski, B.Sc., A.M.I.E.E., and S. J. Zgorski (12s 6d), shows that the design of much electronic equipment can be considerably simplified, and its reliability improved, if it is operated from a constant voltage h.t. supply. It is often economical, therefore, to provide such a supply line or lines, stabilised by means of suitable electronic circuits. The cost of stabilised power supplies has been considerably reduced in recent years but is still rather high and represents a significant capital outlay where the total amount of power drawn from stabilised lines is several hundred watts or more. Powers of this order are required in most laboratories and even in individual equipments, electronic computers or industrial process controllers.

It appears that a reduction of the total cost, with a simultaneous improvement of performance, may be achieved by using a central primary d.c. source supplying a number of stabiliser units, rather than a number of self-contained mains-operated stabilised power packs. A system of this type has been developed and installed in

the E.R.A. network analyser and its associated development laboratory. The design and performance of the stabiliser units employed in this system are described in detail in the report.

The existing literature on electronic stabilisers is either mainly theoretical or is concerned with the performance of particular designs. Little guidance can be found on the planning of a power system and on the practical design of a stabiliser to satisfy a given specification. A systematic treatment of this important subject is outside the scope of the present report, but an outline is given of the process by which the particular design described has been arrived at. A brief theoretical analysis is included in the appendix.

Debye Losses

Vacancies in some crystals trap electrons. The conditions under which such trapped electrons give rise to Debye type of electric loss are discussed. It is shown in Ref. L/T348, "Debye Losses Due to Electrons Trapped at Vacancies," by J. A. Sussmann (9s), that such behaviour can be expected when the vacancy has either three or four equal, equidistant, nearest neighbours, provided the wave function of an extra electron has *p* symmetry near each of the neighbouring atoms. Some possible applications are discussed.

Electrogyro Locomotive

A NOVEL type of shunting locomotive has been developed by the National Coal Board and is now undergoing surface trials at Seaton Delaval in Northumberland. Known as the electrogyro locomotive, it derives its power from two large flywheels which rotate at speed to store energy which is then converted into electrical power and used to drive the locomotive.

Electrical energy is supplied from a contact mast to two induction motors which start the flywheels storing kinetic energy. When the locomotive moves, the stored energy is reconverted into electrical power and supplied to two traction motors which turn the road wheels.

It takes about 2½ min to speed the gyros enough for about 30 minutes' operation. Because the operating cycle of electrogyros corresponds to the usual haulage duty required in the mining industry of a short run followed by a stop, this type of motive power offers the possibility of hauling underground trains with improved efficiency. The construction of a flameproof underground gyro locomotive will be considered if the system and equipment prove to be technically and economically sound.

In the present trials, three charging stations are being used; one in the locomotive shed and two about a mile apart on the track. When the locomotive is at a charging mast a collecting pole is swung out pneumatically connecting up with four bare contact rails which are not alive until a pilot circuit closes the contactor in the charging station. When the mast is swung back the locomotive can move off.

The flywheels are a little over 5ft in diameter and weigh about 1½ tons each. The stored energy of the gyros at maximum speed is 9 kWh and they are cooled by hydrogen at reduced pressure. The principle of operation is that a three-phase induction motor will generate when driven externally and excited by condensers. The value of the capacity is regulated by the driver. The electrical equipment was produced by the Swiss firm of Oerlikon and the mechanical parts were built by Sentinel (Shrewsbury), Ltd.

Dry Cooling Towers

A COOLING system for power stations which makes it possible to site them in areas where large volumes of cooling water are not available, or can only be provided at excessive cost, has been developed by the English Electric Co. The announcement that negotiations were in hand for the design and construction of a commercial scale installation was made recently by the Central Electricity Authority.

The essential features of the new scheme are the injection of pure water into the steam and the cooling of the mixture of water and condensate by air in large heat exchangers, or coolers, of special design fitted round the base of the dry cooling tower. In the new system the initial supply of water is used again and again, with only comparatively slight losses to be made up.

Since the system is completely closed the water in circulation will be of condensate purity, and the plant will therefore be free from internal corrosion. The flow of air through the cooler is produced by either induced draught fans or natural draught.

Two factors contribute to the overall economy of the scheme—firstly, the cooler, which is made entirely of aluminium and is simple, effective and cheap to construct, and secondly, the incorporation of the spray condenser, which eliminates the drop in temperature between the condensate and cooling water that occurs in the conventional condenser.

The company states that its studies indicate that as soon as cooling water becomes a special problem for any reason, the scheme will be quite frequently more economical overall than the normal systems. When it is desired to site a station at a distance from natural sources of cooling water, the dry cooling tower provides a technically sound and potentially economic solution.

Letters to the Editor

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents

Unshaded Street Lamps

I WOULD like to reinforce Mr. C. T. Trigg's plea for shaded street lighting (your issue of 29th November). Whatever lighting engineers may say about "tunnel effect" and the like there is no doubt that for the motorist it is the pleasantest, safest lighting to drive in.

Unshaded lamps, particularly when white or blue-white, do little more than indicate to the squinting driver which way the road goes.

Speaking more generally, I am amazed at the disparity between theory (shown by polar diagrams and photographs of "ideal" lighting in learned journals) and practice on our ill-lit roads. Why, for instance, does someone not lay down that the only light of any real value is the sodium lamp? I would like to hear the views of anyone who disagrees with this.

C. R. CADMAN.

I HAVE just come across the letter from Mr. Trigg in your issue of 29th November and I write in wholehearted support of every word he says. There has been a spate of articles lately on the art and science of lighting, and it is apparently a cardinal rule that a naked light hides more than it reveals. Motorists have cause to be aware of this, yet the last word in street lighting is seemingly to shine more and better lights in our eyes.

Edinburgh, 12. R. Y. MCLEAN.

SHIPPINGPORT

America's First Nuclear Power Station

From a Correspondent

AT Shippingport in Pennsylvania, work is almost completed on what will be the first nuclear power plant designed exclusively for the production of electricity. The station is being built for the Duquesne Light & Power Co., in co-operation with the United States Atomic Energy Commission.

The reactor is of the pressurised water type, which is favoured in the U.S.A. as likely to be most competitive with other heat sources. In this type of reactor the water serves two purposes. It acts as a coolant to remove the heat caused by the fission processes and it also serves as the moderator. At Shippingport the water is heated to 545 deg F at a pressure of 2,000 p.s.i. and is then pumped through heat exchangers to boil condensate and generate steam for the turbine. Steam pressure at the turbine stop valve is 600 p.s.i.

Four pressure vessels are used to contain the reactor and the steam generators. These are built of steel 1½in thick and are surrounded by reinforced concrete biological shields 5ft thick. Fuel for the plant is a combination of natural and enriched uranium. Spent fuel is removed via a canal under water for reprocessing. A waste disposal area is provided on the site for storage until it can safely be removed.

When the station goes into service it will generate 60 MW for the Duquesne system; an ultimate generating capacity of 100 MW is planned. The plant was to be ready for operation during December and the reactor went "critical" early in November. The station is expected to be feeding into the local power system network within the next few weeks. The United States will then have no fewer than seven types of nuclear reactor in operation, although the Shippingport reactor will be the only one producing electricity on a commercial scale. No serious attempt has been made to bring costs down to a competitive level with other forms of energy as it is felt that, with the low cost of coal and the large though dwindling sources of hydro-electric power, this would be impossible. Stress has therefore been placed on a wide knowledge of reactors rather than on the actual problems of nuclear generation of power on a commercial scale. The director of America's equivalent of Harwell, the Argonne National Laboratory, has summed up the need as "Know how—not kilowatts."

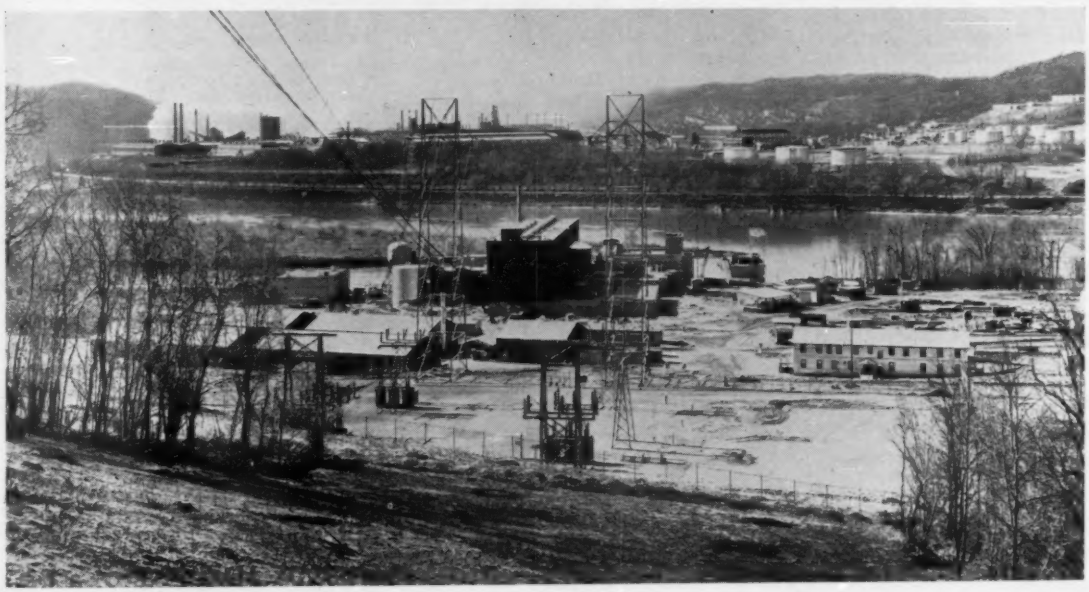
Other Nuclear Projects

This has led to a situation where a number of reactors are in operation or in the process of building on an expensive research basis. At present the largest station being built in the United States is the 236 MW plant for Consolidated Edison on the Hudson River. Apart from this station, which is not yet above the foundation stage, and one other 180 MW plant, progress has been confined to very small experimental stations.

The long-term outlook adopted by the private companies in this programme now seems to be in danger of some drastic revision unless more Federal financial support becomes available. Already plans for a nuclear plant have been abandoned by one utility in view of an increase in the cost estimates of almost 70 per cent.

At the outset of the nuclear energy programme a large number of private companies in the United States showed

Shippingport nuclear power station in Pennsylvania



eagerness to participate, but it seems that prospects are too remote to be of any use to companies which must show their investors some reasonable returns. A number of utilities and manufacturers in the United States have now decided to leave the nuclear energy field. Other firms have slowed down their reactor programmes and reduced their research facilities. A meeting of the U.S. Atomic Energy Commission was called for December to confer with the manufacturers and utilities on the prospects. It seems certain that the present expensive research must receive more Federal support if it is to go on and since the most optimistic estimates do not point to competitive nuclear power before 1970, a long programme of financial aid will be needed.

Engineers as Managers

A BROADER education, with less specialisation; the early selection and training of managers; and a much wider use of the engineer in management were advocated by Sir Ewart Smith at the Institution of Civil Engineers recently when he delivered the fourth Graham Clark Lecture to the Institutions of Civil, Mechanical and Electrical Engineers. His subject was "The Engineer and Management." Sir George Nelson, president of the Institution of Mechanical Engineers, was in the chair.

Sir Ewart said that as a design engineer he had been taught that three principles lay behind good design—simplicity, symmetry and continuity. These principles were equally applicable to the problems of management. They did not include uniformity; egalitarianism and uniformity by their nature tended to halt, not to help, progress.

Specialisation Inevitable

Speaking of education, he said: "Knowledge is accumulating at a great rate and, since the capacity of the human mind and the span of human life, within close limits, are not changing from generation to generation, specialisation becomes inevitable, even within sectors of the same field. This should not imply that we must start educating every boy and girl at 14 as a specialist. Unfortunately, our educational system has been running in this direction. There is a danger that specialisation and research are tending to be regarded as an end rather than an aim in achieving an integrated result.

"With the growth of specialisation we must take more and more care to select, train and educate people who will be general in their approach. Such people must have some conception of what the specialists are trying to do and therefore they must have a good background and some experience in a wide variety of jobs, but the function of the specialist himself must be to help and not to control."

If we accepted this need for a broader approach in education, the main change had to be made in the schools, although the universities held the key in their scholarships and entrance examinations and the length of their courses to the first degree. The curriculum of this broad-based school education should centre around history, supported by a language, and physics, supported by mathematics. This would end the curse of early specialisation and enable the pupil to defer his choice of a career to an age at which he was better fitted to make it.

Above all, good education depended on good teaching. If a large proportion of the £100 million which the Government proposed to spend on new buildings and equipment over the next few years were taken to train and pay teachers adequately, the country would be infinitely better off.

Early selection and training for management was crucial. The way young entrants were treated in the first four or five years would in large measure determine what sort of men they would be, because if they were left in one job for five or ten years they would dig for themselves a deeper and deeper groove. How could a manager make a sound decision unless in his early years he had had a wide variety of experience?

The manager must be ready to organise and plan in a dynamic manner after analysing the facts; he must make the appropriate decisions and exercise control over the operations for which he was responsible; he must always have regard to human and psychological factors; he must have a clear idea of purpose and state his objectives in understandable terms.

Because of his experience, the engineer was peculiarly well equipped to undertake wide managerial responsibilities, but in spite of their inherent advantages engineers were not outstanding in senior management in industry or Government. He understood that 40 per cent of the companies in the engineering industry had boards containing no technically qualified member, less than 22 per cent of all the directors of engineering companies had technical qualifications, and of those only three-quarters were engineers. In general industry, despite the growing dependence on mechanisation, the position was far worse.

We required, therefore, a basic broadening of education; to warn all young engineers of the present danger; and, in senior management, to help the young engineer by moving him from one job to another and giving him a wide experience and the maximum responsibility he could accept. Eventually, his role in top management should not be merely that of technical adviser; he should take his full part in leadership.

Linear Accelerator for Research

A 4 MeV linear accelerator has been ordered by British Petroleum, Ltd., for their research station at Sunbury-on-Thames. It is believed to be the first machine of its kind in the country to be built specifically for industrial research in the petroleum and chemical industries.

The accelerator provides a compact, easily-controlled source of high-energy electrons, deep-penetration X-rays or neutrons, the last two being produced by causing the electron beam to hit a suitable target. The machine is of the travelling-wave type, using radio frequency power generated by a magnetron operating at 3,000 Mc/s. Mean electron energy is 4 MeV, and mean electron output 800 W at 500 pulses per second. The pulse repetition frequency is variable between 100 and 500 pulses per second. The maximum X-ray output using a tungsten target is 700 roentgens per minute at 1-metre distance.

A special building is being constructed to house the unit. The design and construction of the accelerator and its associated control equipment are being undertaken by Mullard Research Laboratories on behalf of Philips Electrical, Ltd., the contractors.

GENERATION AND DEVELOPMENT

Power Station Contracts

The Central Electricity Authority placed contracts during the past month for power stations amounting in the aggregate to £8,533,000. The principal contracts, which include six turbo-alternators with an aggregate capacity of 840 MW, are as follows:—

West Thurrock power station: Three circulating water pumps.—Sulzer Bros. (London).

Spondon H.P., near Derby: Main superstructure.—J. Gerrard & Son.

Willington "B," near Derby: Two 200 MW turbo-generators, condensing and feed heating plants.—Metropolitan-Vickers Electrical Co.

Rugeley: Two 120 MW turbo-generators.—C. A. Parsons & Co.

Aberthaw: Two 100 MW turbo-generators.—C. A. Parsons & Co. Circulating water pumps and equipment.—Gwynnes Pumps.

Uskmouth, Newport: Four circulating water pumps and equipment.—Gwynnes Pumps.

Skelton Grange "B," Leeds: Turbine house frame and roof.—J. L. Kier & Co.

Capital Investment in Southern Area

The chairman of the Southern Electricity Board (Mr. R. R. B. Brown) gave the Consultative Council the following information on the capital investment position for the next two years (1958-59 and 1959-60) when the Council met at Reading on 17th December. The allocations to the Southern Board would be £8·15 million and £8·25 million, respectively, he said. The actual expenditure in 1956-57 had been £7·2 million and expenditure for the current year might reach £8·3 million. The Board would therefore not be required to reduce expenditure but rather to prevent it from rising beyond the present level. It should be assisted in this by the easing of the demand for connection to new and existing premises, which was already apparent, and it was not expected therefore to have to postpone any essential reinforcement work or introduce restrictions in respect of new supplies, but a careful watch would have to be kept on the position.

Supply Standardisation in Dunfermline

A ceremony at the Transy substation, Dunfermline, on 19th December marked the completion of the change-over from the two-phase a.c. system to the standard a.c. supply which has been in progress in the town over the last eight years. Mr. G. T. Allcock, Fife area manager of the South of Scotland Electricity Board, speaking at a dinner party held in the Brucefield Hotel, Dunfermline, said that the work had been completed ahead of schedule. The cost was expected to be in the region of £320,000, compared with the estimate of £400,000.

Generation Starts at St. Fillans

St. Fillans power station, part of the North of Scotland Hydro-Electric Board's Breadalbane project in Perthshire, went into operation on 24th December. When the scheme is completed 392 million kWh will be added to the Board's annual production of electricity. It embraces the Killin, St. Fillans, and Luib sections; Killin is already operating, and Luib has not yet been started. There will be eight power stations in all with a total capacity of 126 MW.

St. Fillans generating station is just off the main road to Lochearnhead, overlooking Loch Earn. It is equipped with a Francis turbine built by the Harland Engineering Co. driving a 21 MW Bruce Peebles alternator. The estimated average annual output is 76 million kWh. The plant is housed in an underground cavern excavated from the solid rock. The discharge from the turbine goes into Loch Earn, from which a tunnel leads to a 4 MW generating station at Dalchonzie, halfway between St. Fillans and Comrie.

It had been the Board's intention to leave the walls of the St. Fillans station in their natural state and enhance the grotto-like atmosphere with suitable lighting. Fissures, however, began to appear in the gable wall directly behind the turbo-alternator and it was decided to face the wall with concrete.

Value of Atomic Power in Ulster

Mr. T. G. Christie, chief engineer of the Electricity Board for Northern Ireland, said in Belfast on 12th December that the building of Ulster's nuclear power station would enable electricity to be provided where it was most needed, and allow new industries and residential communities to be set up anywhere in the Province.

Mr. Christie, who was speaking on "Electricity Supplies" at a meeting of the Northern Ireland section of the Town Planning Institute, said that demands were increasing to such an extent every year that it was necessary to double the capacity of generating plants every eight years. The present trend of demand and load development in Ulster indicated that the next major addition to the generating facilities should be made as near as possible to the load centre of the Board's area, as the loads distributed in this area now exceeded the combined loads of Belfast and Londonderry.

Until now it had been necessary to build generating stations where coal could easily be delivered from ships, but the advent of nuclear energy had opened up new possibilities for sites either inland or on the seaboard which would not otherwise have been economically practicable. Apart from the importance of this fact in relation to widespread industrial development, and the provision of work within a reasonable distance of the homes of the people, Mr. Christie said that scope would be given to planning authorities in the matter of selection of sites for new industrial and residential communities.

Stirling Tenants' Freedom of Choice

By 14 votes to six Stirling Town Council recently decided that tenants of new houses should be given freedom of choice between gas and electricity. The Housing Committee had recommended that future housing schemes should be all-electric, gas being excluded.

Coal Price Stabilisation Urged

The Merseyside and North Wales Electricity Consultative Council, at its meeting last week, unanimously endorsed a local committee resolution urging the Minister of Power to consider the desirability of stabilising the price of coal. Mr. T. Consterdine (Crewe) said they would be failing in their duty to electricity consumers if they did not register the strongest possible protest against the ever increasing cost of coal.

The chairman (Mr. J. Evans) said that when the mines were nationalised he was one of those who held the opinion that without a direct subsidy it would be impossible to keep the price of coal at a reasonable level. That opinion was rejected by the Government, but subsequent events had emphasised that if the price of coal was to be maintained there would have to be a subsidy. He announced that the date of operation of the new electricity tariff structure due to begin in January had been deferred.

Overseas

Large Dam for Pakistan

Messrs. Binnie, Deacon & Gourley, the civil engineering consultants, have been notified of the acceptance of a contract for the construction of a large earth dam on the Jhelum River in Pakistan. The scheme provides for the irrigation of about three million acres of land in West Pakistan and the development of 300 MW of electric power.

NEW ELECTRICAL EQUIPMENT

Storage Heaters

THERMODARE (GREAT BRITAIN), 94-98, Petty France, London, S.W.1, announce that they have now fitted a double braided fuse link, bushed at entry, in their new fully guarded storage heaters (models L, LV and LH). This is claimed to eliminate all possibility of the link becoming damaged in transit or handling. The company offers free service on models with which any difficulty may have been experienced.

Electric Blankets

A recent announcement from H. J. BALDWIN & CO., LTD., 132, Arkwright Street, Nottingham, states that all models in their "Thermat" range of electric blankets are now approved by the British Standards Institution under licence No. 2731.

A similar announcement is made by THERMOSET APPLIANCES, LTD., Chapel Works, Failsworth, Manchester, who say they have now received B.S.I. licence No. 2734 permitting them to put the "Kite" mark on their "New Era," "Cozee" and "Everest" electric blankets.

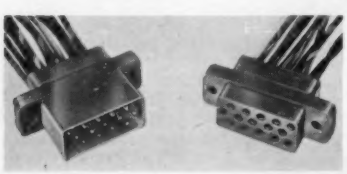
Extensible Leads

New types of extensible leads suitable for use on electric irons, kettles, clippers, etc., have been produced by CREATORS, LTD., Plansel Works, Sheerwater, Woking, Surrey. They have an extension ratio of 4 : 1 and up to five conductors can be used in their construction. The outside braiding is available in acetate or nylon.

Miniature Connector

The fifteen-way high voltage miniature connector which is now being made by the PLESSEY CO., LTD., Ilford, Essex, has a number of interesting features. The pins or inserts are connected to the cable by soldering or crimping away from the moulding, permitting closer pin spacing, and requiring less skilled operation than the orthodox method of soldering multi-pins *in situ*.

Both plug pins and socket inserts are fully shrouded in single piece, high-density polythene mouldings, which not only eliminate the need for gaskets but also provide the necessary insert anchorage and protection against vibration.

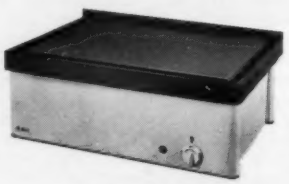


Plessey 15-way miniature connector

Plugs and sockets may be used either as fixed or free units and although the connectors are primarily designed to accommodate cables up to a maximum of 14/·0076, any similar multi-stranded cable up to a maximum o.d. of 0·075in and maximum conductor o.d. of 0·034in may be used. These connectors have a working voltage of 1 kV, a current rating of 2·5 A per contact, and are suitable for temperatures up to 80 deg C. The unit is very compact, occupying a total space of 0·75 sq in, and 22- and 30-way units are being developed within this dimension.

Griddle Cooking Plate

A small cooking unit which will enable caterers to cook food in view of customers has been added to the range of light catering equipment produced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. It is a griddle plate with a loading of 2½ kW and is capable



G.E.C. griddle plate

of cooking twelve chops every 10 minutes. A "Simmerstat" and a small neon indicator are fitted and the body work of the unit is finished in mottled grey vitreous enamel. The top plate is of cast iron and a cast-in groove round the edge of the plate enables surplus fat to drain away into a removable container which is fitted at the back of the unit. Models are available for 200/210, 220, 230/240 and 250 V. The price is £26.

Engraving Machines

The "Dowling" models 848 and 713 bench engraving machines have been adapted for use as electrical etchers by the manufacturers, DAVID DOWLING, LTD., Roebuck Lane, Hainault, Ilford, Essex, and are now equipped with etching heads and transformers made by the Martindale Electric Co., Ltd.

They are suitable for marking materials such as case hardened steels, hardened alloy steels and high speed steels, where the conventional engraving heads would be inadequate. Both models can be supplied as etching machines or with both etching and engraving heads. As etchers, they are available with a writing point, a three-heat transformer, two clamps, a three-line copy holder and more than 150 characters. Dependent upon there being a reasonable demand, the manufacturers also hope to adapt the machines to incorporate vibratory marking heads.

Engine-driven Welding Set

A new diesel engine-driven arc welding set has been added to the range of equipment made by QUASI-ARC, LTD., Bilston, Staffs. Known as Type DEB.400U, it is of robust construction, but its low weight and relatively small size permit easy manœuvrability. The set has quick voltage recovery and is particularly suitable for depositing the cellulose-covered types of electrode frequently used in positional pipe welding.

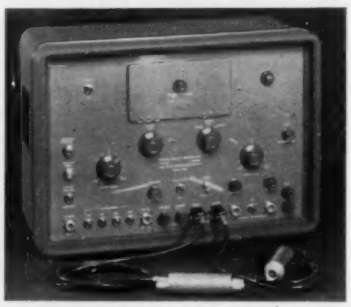
The set is driven by a Ford four-cylinder diesel engine and has a maximum current output of 400 A, the maximum continuous hand welding current (to B.S. 638 : 1954) being 300 A. The N.E.M.A. rating is 300 A d.c. with an arc voltage of 40 V and a duty cycle of 60 per cent.

Silicon Power Diodes

It is announced that the "SenterCel" silicon rectifiers, types RS20A, RS21A and RS22A, made by STANDARD TELEPHONES & CABLES, LTD., Rectifier Division, Edinburgh Way, Harlow, Essex, have been granted full Joint Service quality approval. These rectifiers are available in quantity and their forward current rating at 35 deg C is 0·5 A with reverse voltage ratings of 50 V, 100 V and 150 V respectively. Each device weighs only 1·25 grams and is smaller than a ¼ W resistor. Their high temperature operating qualities permit operation in ambient temperatures of 100 deg C with suitable de-rating.

Sweep Generator

A new 20 Mc/s sweep generator, Type TF 1099, has been introduced by MARCONI INSTRUMENTS, LTD., St. Albans, Herts., which, in conjunction with a suitable oscilloscope, enables response measurements to be made with a discrimination exceeding



Marconi sweep generator

0·01 dB. It is primarily designed for the precise alignment of monochrome- or colour-television transmitter and studio equipment, but is equally applicable to radar or television receivers where the highest order of measurement accuracy is required.

The sweep starts below 100 kc/s and is continuously variable up to 20 Mc/s; the lower frequency limit is locked to the start of the sweep to ensure a steady display on the c.r.o. The level of the frequency-swept signal is variable from 0·3 V to 3 V peak-to-peak, and the selected output level is held constant to within ±0·1 dB.

A 250 V time-base waveform, synchronised to the sweep frequency, is provided for connection to the X-plates of the c.r.o., and a series of marker pips at 1 Mc/s intervals is available for superimposing on the display to facilitate accurate frequency identification. The instrument also incorporates circuits for precision differential measurement.

Appliance Switches

The latest additions to the range of Cutler-Hammer appliance switches made by N.S.F., LTD., 31-32, Alfred Place, London, W.C.1, measure less than 1⅞in by 1½in by 1⅜in. These new three- and four-pole lever switches are rated at 10 A and are claimed to be a significant advance in the design of

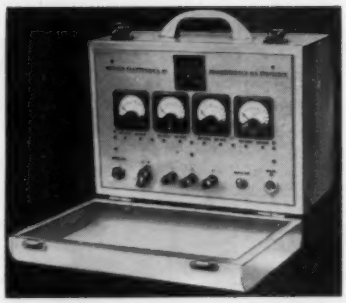
N.S.F. three-pole switch

small sized, high capacity switches. Both are designed for one-hole mounting.

The three-pole switches have sliding action contact mechanism, which ensures simultaneous breaking of all three contacts, an essential feature when switching three-phase motors. The four-pole types have many applications in the field of electronics and automation.

Millisecond Stopclock

A millisecond stopclock designed for all types of time measurement which covers the range from 0·1 m.sec to 27·8 hours has recently been introduced by VENNER ELECTRONICS, LTD., Kingston By-Pass, New Malden, Surrey. The instrument is constructed from nine transistorised packaged stages. The basic time reference is a transistorised crystal oscillator operating at a frequency of 10 kc/s. Pulses from the oscillator are passed via a gate to four transistorised decade counters and thence to a cyclo counter. The division ratio provided by the four decades is 10,000, therefore the cyclo counter receives one pulse per second.



The "Venner" millisecond stopclock

The gating is arranged so that the closed or open times of contacts can be measured, or the time between one pair of contacts opening or closing and another pair opening or closing. Pulse operation is also catered for, as a positive pulse can be used to start or stop the instrument. The facility enables relay timing to be accomplished among many other applications.

Forty-six transistors are employed in the instrument but the consumption is only 1 W at 12 V. The instrument is fitted in a lidded case measuring 13in by 9in by 7½in. A battery carrying case is available for portable operation, and a transistor stabilised power supply can be used for mains operation.

Spin Dryer

The "Chilton" electric spin dryer is now being manufactured in this country by CHILTON ELECTRIC PRODUCTS, LTD., Hungerford, Berks. The new dryer, though similar in size and construction to the model previously imported from Belgium and marketed by the company, has several new features.

The original black and ivory colour scheme has been altered and the dryer is now finished in white, and lettered and banded in red and gold. The black rim, grey spout and base of the dryer have also been restyled. The speed of the inner dryer has been increased to 2,400 r.p.m. (previously 2,100 r.p.m.) and, it is claimed, the amount of water extracted is correspondingly greater. The price has been increased from 26 gns. to 27 gns. including purchase tax in the United Kingdom.

The new "Chilton" spin dryer

Washing Machine Survey

It is regretted that in our Domestic Electrical Equipment Survey dealing with washing machines (20th December) details of the "Vactric" washing machine manufactured by VACTRIC, LTD., 196, Sloane Street, London, W.1, were inadvertently omitted. The particulars of this machine, which makes use of a moulded polyester glass fibre for the tub construction, are as follows:—It is a cabinet model measuring 36in high by 20in wide by 22in deep with a tub capacity of 9 lb (dry clothes). The agitator is made of a highly durable plastic, lessening the risk of possible damage to clothes, and its 8-position wringer can be used for dealing with one batch of clothes whilst another is in the washing process.

It is a fully heated model (two 1,500 W thermostatically controlled elements) and, it is claimed, the water maintains its temperature for a longer period than with a metal tub. The water can be emptied by means of a powerful pump within 2½ min. The exterior finish is in cream or white and the tub interior is in pastel green. The price is £56 17s plus £21 18s purchase tax in the United Kingdom.

Vactric washing machine

Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets are feeling their way with considerable caution into the New Year. In the immediate foreground the prospect is obstructed by the general effects of the credit squeeze at home and by the news of business recession from America. However, markets were thoroughly deflated by events in the last quarter of the past year, and are consequently in condition to respond actively to the first signs of fresh encouragement. The firm behaviour of Government securities since the Bank Rate change is acting meanwhile as a steadying influence on investment confidence in general.

Babcock & Wilcox are to be responsible for one of the first major capital issues of the year. They plan to raise nearly £4 million by the issue of £2 million debenture stock and a "rights" offer of about 1·9 million new £1 ordinary shares at par.

Price Changes

In the fortnight covered on this occasion by the accompanying price lists, the changes marked are mostly on the down side, but seldom of any great consequence. Among the larger falls were those of half-a-crown each in A.E.I. and English Electric. Hackbridge Holdings were marked down to 10s 6d after the announcement of a reduction in the interim dividend from 10 to 7½ per cent; and General Cable to 12s on the lower final dividend declaration, which brings the total for the year to 24 per cent, against 30 per cent previously. Of others in the cable group, W. T. Henley's and Scottish Cables also lost ground. Babcock & Wilcox were quoted lower at 53s 9d as a first reaction to news of the coming issue, and to the company's statement accompanying the announcement.

Recent Issues

Automatic Telephone & Electric new £1 ordinary shares, offered to existing holders at 52s 6d, are now 20s paid-up, with the final instalment of 32s 6d payable by the 17th of this month. They have been quoted lately at an all-in price of 57s 9d, to yield a fraction under 6 per cent on the present rate of dividend, and can still be bought free of the usual 2 per cent transfer stamp duty. Also available free of stamp duty are the new 5s ordinary shares of Duport, at 9s 3d, and of Desoutter Bros., at 14s, the latter being in the form of "A" (non-voting) shares. Yields on these new shares, both of which result from scrip issues, are approximately 6¾ per cent on Duport and 5¾ per cent on Desoutter, assuming in each case that the present rate of dividend is scaled down in proportion to the increase in capital.

Contactor Switchgear

At last month's 21st annual general meeting of Contactor Switchgear,

Price Changes in

Company or Board	Nom. Value	Middle price 30th Dec.	Fortnight's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1957 Highest	1957 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	72		3	3	4 3 3	80	70
Brit. Elec. 1974/77	100	68½		3	3	4 7 6	78½	66
Brit. Elec. 1976/79	100	72		3½	3½	4 17 3	81½	70
Brit. Elec. 1974/79	100	82½		4½	4½	5 3 0	92½	79½
Overseas Electric Supply								
Calcutta Elec.	£1	16/9	—1/3	6†	6·8†	8 2 0†	19/-	15/-
East African Power	£1	19/6	—6d	7	7½	7 13 9	21/-	19/-
Nigerian Elec.	£1	16/6		10	10	12 2 6	18/6	16/6
Perak Hydro-Elec.	£1	15/6	—6d	10	12½	16 2 6	18/-	13/3
Electrical Shares								
Aberdare Cables	5/-	10/6		17½	17½	8 6 9	12/-	9/9
Aerialite	1/-	6/-	—3d	48	51½	8 11 9	6/9	4/9
Allen, W. H.	£1	35/-		10	10	5 14 3	47/3	33/6
Anglo-Portuguese Tel.	£1	21/9		8	8	7 7 3	27/6	20/6
Aron Elec. Ord.	£1	55/-		15	15	5 9 0	60/-	53/6
Assoc. Elec. Ord.	£1	47/6	—2/6	15	15	6 6 3	73/-	48/9
Automatic Tel. & El.	£1	57/6		15	17	5 18 3	75/-	54/6
Babcock & Wilcox	£1	53/9	—5/-	15	15	—	82/6	54/9
Bakelite	10/-	21/3		16	15	7 1 3	24/6	20/9
Baldwin, H. J.	2/-	3/9		20	20	10 13 3	5/-	3/9
Barry's Electric	5/-	6/-		—	10	8 6 9	6/6	5/6
British Aluminium	£1	41/3		12	12	5 16 6	71/3	38/9
Brit. Elec. Traction: Def. Ord. "A"	5/-	19/-	—3d	22½	25	6 11 6	25/-	17/-
B.I. Callender's	£1	40/3	—6d	12½	12½	6 4 3	55/-	39/6
B.I. Callender's 6% Pref. ...	£1	20/-		6	6	6 0 0	21/9	19/-
British Tabulating	£1	41/3	—6d	9	10	4 17 0	56/3	37/6
British Thermostat	5/-	21/3		25	25	5 17 9	27/6	21/3
British Vac. Cleaner	5/-	5/-		15	10	10 0 0	8/-	5/-
Brook Motors	10/-	33/9	—1/3	25	25	7 8 3	37/6	30/-
Bulgin, A. F.	1/-	4/6		50	40*	8 17 9	5/6	4/-
Burco Dean	5/-	13/9	—3d	20	22½	8 3 6	14/-	8/9
Cable & Wireless: Ord.	5/-	9/6	—3d	10	10	5 5 3	12/6	9/6
4% Loan	100	90½		4	4	4 8 6	92½	89
Chloride El. Storage "A" ...	£1	57/6	—1/3	17½	17½	6 1 9	68/9	55/9
Clarke Chapman	£1	135/-		22½	27½	4 1 6	9	5½
Cole, E. K.	5/-	17/-	—6d	17½	17½	5 3 0	23/6	16/6
Cossor, A. C.	5/-	5/-	—3d	Nil	2½	2 10 0	7/3	5/-
Crabtree	10/-	24/3		20	20	8 5 0	26/-	23/3
Crompton Parkinson Ord. ...	5/-	15/-		16	16	5 6 9	17/9	14/-
De La Rue	5/-	21/9	—6d	30	35	8 1 0	24/9	16/3
Decca "A"	4/-	24/6	—1/3	43½	43½	7 2 9	32/3	22/-
Desoutter	5/-	15/6		30	32½	5 4 9*	17/9	13/9
Dewhurst	2/-	7/6		16½	20	5 6 9	7/9	5/9
Dictograph Tel.	2/-	5/6	—3d	20	20*	7 5 6	6/3	5/3
Dubilier Condenser	1/-	3/3		30	30	—	5/3	3/-
Duport	5/-	9/3x.c.		25	25	6 15 3	10/6	8/6
E.M.I.	10/-	27/9	—1/3	15	15	5 8 0	36/-	23/9
Electrical Components	5/-	7/3		25	12½*	8 12 6	8/-	6/6
Elec. Construction	£1	22/6	—1/3	8½	8½	7 11 0	27/6	21/9
Elliott-Automation	5/-	12/-	—6d	—	10‡	4 3 3	12/6	10/3
Enfield Cable Ord.	£1	12/9		Nil	Nil	Nil	21/6	12/3
English Electric	£1	47/6	—2/6	12½	14	5 17 9	65/-	47/6
English Electric 3½% Pref. ...	£1	12/3		3½	3½	6 2 6	14/3	11/3
Ericsson Tel.	5/-	19/3	+3d	20†	22‡	2 17 0*†	25/-	17/-
Ever Ready	5/-	14/-		35	37½	6 14 0*	20/-	14/-
Falk Stadelmann	£1	36/3		17½	17½	9 13 0	40/6	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

approval was given to the capitalisation of £100,000 of the reserves in making a one-for-two scrip issue, and the company's 5s ordinary shares are accordingly now quoted ex that distribution. The quotation is 9s 6d, with the new shares a fraction higher by virtue of being transferable free of stamp while in allotment-letter form. Shareholders have been advised not to take the issue as an indication of an increase in the amount of the dividend.

Electrical Investments

Company or Board	Nom. Value	Middle price 30th Dec.	Fortnight's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1957 Highest	1957 Lowest
Electrical Shares—continued								
G.E.C. Ord.	£1	37/6	—1/3	14	12½	6 13 3	58/9	37/6
G.E.C. 6½% Pref.	£1	20/6		6½	6½	6 6 9	23/6	19/6
General Cables	5/-	12/-	—6d	30	24	10 0 0	15/6	11/6
Greenwood & Batley	£1	47/6		17½	17½	7 7 3	51/3	45/3
Hackbridge Holdings	5/-	10/6	—1/3	30	20	9 10 6	21/9	11/3
Hackbridge & Hewittic	5/-	11/3		23	20	8 17 9	16/-	10/-
Head Wrightson	5/-	18/6		20	22½	—	24/3	16/6
Heatrae	2/-	4/9		15	15	6 6 6	4/9	4/-
Henley's	10/-	11/-	—6d	11½	11½	10 9 3	17/-	11/-
Holophane	5/-	13/-		30	37½	8 13 0*	15/9	10/3
Hoover	5/-	32/6	—1/-	50	50	7 13 9	44/-	24/9
I.C.I.	£1	37/9	—1/6	10	10	5 6 0	46/6	36/3
Intl. Combustion	5/-	21/-		20	22½	5 7 3	30/-	19/3
Johnson & Phillips	£1	18/9		15	10	10 13 3	34/6	18/9
Lancashire Dynamo	£1	32/6	—1/3	11	11	6 15 3	45/9	33/6
Laurence, Scott	5/-	14/3	—6d	15	15	5 5 3	19/9	13/9
Lister, R. A.	£1	26/3	+6d	10	10	7 12 6	33/9	23/3
London Elec. Wire	£1	41/3		12½	12½	6 1 3	53/9	40/9
Lucas, J.	£1	28/-	—9d	7½	7½	5 7 3	36/6	27/6
Marconi Marine	£1	30/-		10	10	6 13 3	37/-	30/-
Marryat & Scott	2/-	10/6		30	35	6 13 3	13/-	8/-
Mather & Platt	£1	47/-		15	15	6 7 9	63/9	47/-
Metal Industries	£1	22/9		Nil	9	7 18 3	30/-	20/3
Midland Elec. Mfg.	£1	47/6		12½	12½	5 5 3	52/6	45/-
Morphy-Richards	4/-	15/-		50	20*	5 6 9	20/-	11/6
Murex	£1	58/3		20	20	6 17 3	79/6	58/3
Newman Ind.	2/-	2/9		10	10	7 5 6	2/11	2/1
Oldham & Son	1/-	2/6		17½	17½	7 0 0	3/-	2/3
Parnall (Yate)	5/-	6/9	—9d	12	12	8 17 9	8/9	5/9
Parsons, C. A.	£1	52/6		8½	7½*‡	—	71/3	45/-
Plessey	10/-	60/-		30	30	5 0 0	86/3	60/-
Pye "A" Deferred	5/-	12/6	—9d	12½	12½	5 0 0	20/-	12/-
Reyrolle	£1	80/-		16½	17½	4 7 6	110/-	72/-
Rheostatic	4/-	7/9		18½	12½*	6 9 0	10/-	7/-
Richardsons Westgarth	5/-	14/9	—3d	16½	16½	5 13 0	20/-	13/6
Scottish Cables	4/-	13/3	—1/-	27½	27½	8 6 0	19/3	13/3
Simon-Carves	5/-	25/-	+1/3	28½	20*	4 0 0	36/3	23/9
Smith (England), S.	4/-	7/3	—3d	17½	20	5 10 3*	8/-	6/3
Southern Areas	£1	11/3		7½	7½	13 16 9	20/-	11/3
Strand Elec.	5/-	5/9		15	15	13 0 9	8/-	5/9
Sturtevant	5/-	17/9	—6d	15†	15†	4 4 6†	27/-	17/9
Sun Elec.	£1	47/6		25	25	10 10 6	47/6	42/-
Switchgear & Cowans	5/-	9/6		25	25	13 3 3	15/6	9/6
Taylor Tunnicliff	5/-	11/9		15	15	6 7 9	13/9	11/9
T.C.C.	10/-	37/6		25	25	6 13 3	41/3	35/-
T.C. & M.	£1	23/6	—6d	8½	8½	7 4 9	31/-	23/6
Telephone Mfg.	5/-	5/6		10	10	9 1 9	8/-	5/3
Telephone Rentals	5/-	10/3		12½	12½	6 2 0	12/6	9/6
Thompson (John)	5/-	25/-		25	25	5 0 0	37/-	23/6
Thorn Elec.	5/-	21/3		15	17½	4 2 3	26/3	16/3
Thornycroft	£1	27/6		12½	12½	9 1 9	37/6	21/3
Tube Investments	£1	52/6	—9d	13½	15	5 14 3	70/-	51/3
Vactric	5/-	15/-		17½	25	8 6 9	23/9	12/9
Veritys	5/-	6/9		12½	12½	9 5 3	9/3	6/9
Walsall Conduits	4/-	11/6		20	20	6 19 3	15/-	11/-
Ward & Goldstone	5/-	24/-	—6d	35	40	4 3 3*	29/-	18/6
Watford	2/-	6/-		25	25	8 6 9	6/9	5/9
Westinghouse	£1	32/6		18	9‡*	5 10 9	41/3	28/9
West, Allen	5/-	9/9	—6d	15	15	—	13/6	9/6
Wolf Electric	5/-	9/-		20	20	5 11 0*	13/9	8/9

The 20 per cent rate paid for 1956–57 would be equivalent to 13⅓ per cent on the capital of £300,000 ranking for future dividends. On that basis the yield on the shares is 7 per cent. At the meeting the chairman gave a good account of orders on hand and of trading results in the first part of the current financial year.

Fixed-Interest Stocks

A notable feature of Stock Exchange market trends during the last quarter of 1957 was the revival in the demand for industrial debenture, loan and preference stocks. After the general upheaval which followed last September's increase in Bank Rate, these fixed-interest securities have been maintaining their value a great deal more firmly than has been the case with ordinary shares. This reversal of previous form is based, of course, upon the consideration that the restoration of sound money is one of the main objectives of the 7 per cent Bank Rate and the present abnormally high level of interest rates in general, and that opportunities for safe investment on the 6 to 7 per cent yield basis are not likely to be available indefinitely.

Debentures and Loans

As an example of the improvement in the investor's regard for first class fixed-interest securities, it is to be noted that while underwriters were left with some 80 per cent of the £10 million 6 per cent loan issued by Vickers at the time of the Bank Rate change, the stock now stands nearly 2 points over the issue price of 96. Still in partly-paid form, it can be bought free of transfer stamp duty to yield 6⅛ per cent. A return of just about 6 per cent is available from the G.E.C. 6 per cent loan stock, redeemable 1976–81, at 99½. On the 5¾ per cent loan stocks of Johnson & Phillips at 90, and of Telegraph Construction at 95, the returns are respectively 6·4 and 6·1 per cent. English Electric 5½ per cent debenture, redeemable at par between 1977–82, can be bought at 94 to give a return of 5·8 per cent.

Preference Shares

Investment demand for well-secured industrial preference shares is maintaining firm prices and some shortage of stock in the more popular issues. Examples of issues on a yield basis of around 6¼ per cent are G.E.C. 7½ per cent preference at 24s 3d and Automatic Telephone 4 per cents at 12s 9d. Yields of around 6½ per cent have been available lately from such preference stocks as Atlas Electric "fives" at 15s 3d and from the 5½ per cent preference issues of Elliott-Automation and Pye at about 17s. Efco 5½ per cents at 16s give over 6¾ per cent, as do Electric Construction "sevens" at 20s 3d. Yields of over 7 per cent are shown by Vactric 6 per cents at 15s 6d, James Scott 6½ per cents at 18s 6d, and Electrical Apparatus "eights" at 21s.

REPORTS and DIVIDENDS

Babcock & Wilcox, Ltd., are to raise £3,800,000 by a debenture issue and a rights offer of ordinary stock. The debenture issue will be for £2,000,000 nominal to be offered to existing debenture, preference and ordinary stockholders on terms and conditions to be announced. The rights issue will be of 1,881,099 £1 ordinary shares at par on the basis of one new share for every £4 of ordinary stock held. Mr. W. L. Fraser states that the directors are arranging to lease the Ordnance Factory at Dalmuir, Dumbartonshire, and have approved development programmes for the group's subsidiaries and overseas interests. Financial resources are insufficient to meet present capital commitments and the increased working capital needed for an expanding turnover.

It is expected that the profits for 1957 will be similar to those for 1956. An interim ordinary dividend of 7 per cent has already been paid and it is expected that the directors will be able to recommend a final payment in June next of 6¾ per cent on the increased ordinary capital. These payments will be equivalent to approximately 13 per cent in a full year on the increased ordinary capital, and the board hopes to maintain the rate at 13 per cent in respect of the year ending 31st December, 1958. An extraordinary meeting to increase the capital to £16·3 million by the creation of £5 million £1 ordinary shares will be held on 14th January.

The General Cable Manufacturing Co., Ltd.—The directors state that the second interim (and final) dividend for the year ended September, 1957, has been reduced from 18 per cent to 12 per cent, making 24 per cent, less tax, for the year. The group net profit, before taxation, for the year shows a small increase on the profit figure of the previous year but the directors have decided to reduce the dividend and so conserve the finances of the company until a funding operation has been carried through in order to liquidate the bank overdraft.

Pye, Ltd., announces that it has acquired 40 per cent of the capital of Magnetic Devices, Ltd., against the issue of 98,248 "A" deferred ordinary shares of 5s each credited as fully paid. As a result of the purchase Magnetic Devices, Ltd., becomes a wholly-owned subsidiary.

Lightfoot Refrigeration, Ltd., is paying an interim dividend of 3 per cent (unchanged).

New Companies

Amaton, Ltd.—Registered 12th December. Capital £200. Research and investigation into all kinds of electrical and mechanical processes and developments, to carry on the sale and manufacture of rectifiers, semi-conductors, electrical heating equipment, electro-mechanical goods, control equipment, servo-mechanisms, etc. Solicitors: March Pearson & Green, 1, Central Street, Manchester, 2, and Simmons & Simmons, 1, Threadneedle Street, E.C.2.

Certina, Ltd.—Registered 12th December. Capital £50. To import all kinds of mechanical, electrical and technical and other products, including plates used in the manufacture of rectifiers, etc. Other particulars are similar to those of Amaton, Ltd. (above).

Northworks, Ltd.—Registered 12th December. Capital £30,000. To manufacture and produce rectifiers, semi-conductors, electrical heating equipment, electro-mechanical goods, control equipment and servo-mechanisms, etc. Other particulars are similar to those of Amaton, Ltd. (above).

Maine-Lea, Ltd.—Registered 28th November. Capital £100. Manufacturers and distributors of electronic devices, etc. Directors: E. G. Pettifor and Mrs. Eileen D. Pettifor. Regd. office: 42, Dingwall Road, East Croydon, Surrey.

Domestic Aids (Coventry), Ltd.—Registered 28th November. Capital £1,000. Electricians, mechanical engineers, manufacturers of and dealers in electrical apparatus, etc. Directors: G. A. Rudman and L. B. Fannon. Regd. office: 145, Spon Street, Coventry.

Edward Gulliver, Ltd.—Registered 5th December. Capital £1,000. Electrical engineers and contractors, etc. Directors: E. E. G. Gulliver and Mrs. Kathleen M. Gulliver. Regd. office: "West View," Churchill Road, Chipping Norton, Oxon.

Increases of Capital

Holophane, Ltd.—Increased by £100,000, in 5s ordinary shares, beyond the registered capital of £150,000.

James McKenzie, Ltd.—Increased by £20,000, in £1 ordinary shares, beyond the registered capital of £30,000.

Electro-Chemical Research Laboratories, Ltd.—Increased by £19,000, in 36,000 "A" ordinary and 40,000 "B" ordinary shares of 5s each, beyond the registered capital of £1,000.

Meeting of Creditors

President Electrical Appliances, Ltd.—Meeting of creditors on 9th January at 108, Park Street, London, W.1, for the purposes mentioned in sections 294 and 295 of the Companies Act, 1948.

Liquidations

Silvertone Lighting & Radio, Ltd.—Meetings of members and creditors on 5th February at Winchester House, Old Broad Street, London, E.C.2, to receive an account of the winding-up by the liquidator, Mr. B. Silverstone.

Harry Davis Co. (Kidderminster), Ltd., electrical engineers and contractors, 4, Lion Street, Kidderminster.—Winding-up. Liquidator, Mr. W. Le'R. Hand, Colmore House, 21, Waterloo Street, Birmingham, 2, appointed 19th December. Particulars of claims to the liquidator by 31st January.

Bankruptcies

A. Moore, lately carrying on business at 5, Upper Hurst, Mount, Outlane, Huddersfield, and 12, Ray Gate, Mount, Outlane, Huddersfield, as a builder, contractor and electrician.—Trustee, Mr. F. L. Kilby, 27, Bradford Road, Brighouse, Yorks, appointed 16th December.

O. E. Harford, Mount Charles Road, St. Austell, Cornwall, electrical contractor and dealer.—Trustee, Mr. J. W. Shaffery, 4, Tregarne Terrace, St. Austell, appointed 16th December.

A. R. Hunt, trading as Hunt Brothers at 68, Thornaby Road, Thornaby-on-Tees, radio and electrical engineer.—Public examination 14th February at the Court House, 4, Bridge Road, Stockton-on-Tees.

C. Sykes, 10, High Kepplewray, Broughton-in-Furness, Lancs, electrician.—Last day for receiving proofs for dividend 8th January. Trustee, Mr. D. Atkinson, 14, Lowther Street, Carlisle, Official Receiver.

J. G. Sims, 57, Over Lane, Openwoodgate, Belper, Derbyshire, trading as J.G.S. Radio Service, radio and television retailer and electrical contractor.—Last day for receiving proofs for dividend 8th January. Trustee, Mr. R. F. Bendall, 126, Colmore Row, Birmingham, 3.

G. W. South, trading as G. W. South & Co., at High Street, Navenby, Lincs, radio and electrical engineer.—Last day for receiving proofs for dividend 14th January. Trustee, Mr. E. C. Stimpson, 27, Regent Street, Park Row, Nottingham.

R. Corbett and **I. A. J. Merritt,** carrying on business under the style of Corbett and Merritt, at 2b, Junction Road, Andover, Hants, electrical and radio engineers (separate estate of I. A. J. Merritt).—Last day for receiving proofs for dividend 3rd January. Trustee, Mr. A. H. Horler, 54, Endless Street, Salisbury.

E.C.G.D. Trading Accounts

Trading accounts published by H.M. Stationery Office ("Trading Accounts of Government Departments, 1956-57") show that over the financial year ended 31st March last the Export Credits Guarantee Department increased its credit balance on cumulative account for commercial business (Section 1 of the Export Guarantees Act, 1949) from £4,781,371 to £8,123,135.

Premium income for the year was £3·7 million (against £3·6 million the previous year), and operating expenses were £965,909 (£882,532). Claims paid amounted to £5·4 million (£2·3 million), of which it is estimated that over three-quarters will eventually be recovered. Recoveries during the year amounted to £5·4 million (compared with £4·6 million).

Guarantees issued on commercial account during the year totalled approximately £726 million, as compared with approximately £486 million in the previous year. This increase, however, is partly accounted for by deferment into the beginning of the year under review of an unusually high number of renewals and by prompt renewal by endorsement of a substantial number of policies before the end of the same year.

Guarantees given "in the national interest" (Section 2 of the Export Guarantees Act, 1949) "for the purpose of encouraging trade with countries outside the U.K." amounted to £65·2 million (compared with £66·2 million); those given under the same Section "for the purpose of rendering economic assistance to countries outside the U.K." amounted to £5·8 million (compared with £2·3 million).

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

Monday, 6th January

BIRMINGHAM.—James Watt Memorial Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Centre. "Electrical Equipment for Rectifier Locomotives," by H. B. Calverley, E. A. K. Jarvis and E. Williams.

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North East London Branch. "The Affairs of the Association," by the national chairman and the general secretary.

LONDON.—Savoy Place, W.C.2, 6.30 p.m. I.E.E. London Graduate and Student Section. Address by the President, T. E. Goldup.

At the Institution of Electrical Engineers, Savoy Place, W.C.2, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. "The Introduction of Subscriber Trunk Dialling," by A. J. Thompson and N. Walker.

Caxton Hall, Westminster, 7 p.m. E.P.E.A. London Technical Group. "Metallurgical Problems in Power Plant," by M. G. Gemmill.

NEWCASTLE-UPON-TYNE. — County Hotel, Neville Street, 6 for 6.30 p.m. North East Electrical Club. "Earthing and Earth Leakage Protection," by J. A. Robbins.

At the Ministry of Labour and National Service, 93a, Grey Street, 6.30 p.m. Institution of Works Managers, Tyne-Wear Branch. "Some Aspects of Fuel Economy for the Works Managers."

PRESTON. — N.W.E.B. Demonstration Theatre, 19, Friargate. I.E.E. North Lancashire Sub-Centre. "The B.B.C. Sound Broadcasting Service on Very High Frequencies," by E. W. Hayes and H. Page.

SHEFFIELD.—Royal Victoria Station Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. Films: "Power" and "Oil-filled Cables."

WIMBLEDON.—"Prince of Wales" Hotel, S.W.19. A.S.E.E. South West London Branch. New Year's party.

Tuesday, 7th January

EDINBURGH.—25, Charlotte Square, 7 p.m. Incorporated Plant Engineers, Edinburgh Branch. "Construction of a Welded Pipe Line," by R. Downie.

ELTHAM.—Eltham Green School, Queenscroft Road, S.E.9, 7.15 p.m. A.S.E.E. South East London Branch. "The Uses of Gases in Industry," by R. E. Johnston.

GLASGOW.—39, Elmbank Crescent, 7 p.m. I.E.E. South-West Scotland Sub-Centre. "Brushless Variable-Speed Induction Motors," by Prof. F. C. Williams, E. R. Laithwaite and L. S. Piggott.

HAMMERSMITH. — Windsor Castle Hotel, 134, King Street, 7.30 p.m. A.S.E.E. West London Branch. "The Application of Electricity to Heating and Ventilating," by J. R. Kell.

LEEDS. — C.E.A., Yorkshire Division, 1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. "Power System Protection, with particular reference to the Application of Junction Transistors to Distance Relays" and "A Dual-Comparator Mho-Type Distance Relay Utilising Transistors," by C. Adamson and L. M. Wedephol.

LEICESTER.—Grand Hotel, 7.30 p.m. Institution of Works Managers, Leicester Branch. "Safety in Industry," by W. T. Hewins.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Supply Sections. "The Breakdown of Transformer Oil under Impulse Voltages," by Dr. R. Hancox and Dr. H. Tropper.

At the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers, London Branch. Discussion on "Mass Production of Television Tuners," opened by P. C. Ganderton.

At the Royal Society of Arts, John Adam Street, Adelphi Strand, W.C.2, 7 p.m. Incorporated Plant Engineers, London Branch. "A Practical Survey of Automatic Combustion Regulation on Industrial Boilers," by W. R. L. Kent.

Kensington Palace Hotel, W.8. British Industrial Measuring and Control Apparatus Manufacturers' Association. Annual luncheon.

MANCHESTER. — Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Centre. "The Development of Variable-Speed High-Power Drives for Large Wind Tunnels," and "A Variable-Frequency Power Installation for Large Wind-Tunnel Drives," by P. McKearney, L. S. Drake and E. G. Mallalieu.

NEWCASTLE-UPON-TYNE. — Crown Hotel, Clayton Street West, 7.30 p.m. A.S.E.E. Tyneside Branch. "What the Electrical Engineer can do at Home with Light," by R. J. Fothergill.

NOTTINGHAM.—College of Arts and Crafts, Waverley Street, 6.30 p.m. I.E.E. East Midland Centre. "Earth Electrode Systems for Large Electric Stations," by J. H. Humphries.

READING.—Agricultural Hall, 121, Oxford Road, 7.15 p.m. A.S.E.E. Oxford, Reading and Districts Branch. "Floor Heating in an All-Electric House," by E. Lomax.

RUGBY.—Rugby College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Graduate and Student Section. "Pulses and Transformers," by G. Gare, and "Preventing Crane Collisions Electronically," by R. Meredith.

Wednesday, 8th January

BIRMINGHAM.—James Watt Memorial Institute, 6.30 p.m. I.E.E. South Midland Graduate and Student Section. Students' lecture, "Man/Machine Relationships," by W. H. Dunkley.

Birmingham Exchange and Engineering Centre, Stephenson Place, 7.30 p.m. A.S.E.E. Birmingham Branch. "Floor Warming," by S. C. Dineage.

EDINBURGH.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South-East Scotland Sub-Centre. Supply Section chairman's address, "Too Much and Too Little," by Prof. M. G. Say.

Y.M.C.A. Social Room, 14, South Saint Andrew Street, 6.15 p.m. I.E.S. Edinburgh Centre. "The Sales Engineer's Approach to Lighting," by W. J. Burland.

FARNBOROUGH.—R.A.E. Technical College, 6.30 p.m. I.E.E. Southern Centre. "Colour Television," by C. J. Stubbington.

HALIFAX.—Crown Hotel, Horton Street, 7.45 p.m. A.S.E.E. Halifax Branch. "Developments in Mineral Insulated Cables," illustrated by films, by R. B. Thorn.

LONDON.—Great George Street, Westminster, S.W.1, 6.30 p.m. Institution of Civil Engineers. Dugald Clerk lecture, "Lifting Equipment," by W. R. Hockaday.

LUTON.—Luton and Dunstable Chamber of Commerce, George Street West, 8 p.m. A.S.E.E. Luton Branch. "Nuclear Reactors and Instrumentation," by D. B. Owen.

MANCHESTER. — Engineers' Club, Albert Square, 7 p.m. A.S.E.E. Manchester Branch. "Modern Electric Lifts," by W. T. Wagon.

NEWCASTLE-UPON-TYNE. — King's College, College Road, 6.15 p.m. I.E.S. Newcastle-upon-Tyne Centre. "One of my More Interesting Lighting Jobs," by members.

Neville Hall, Westgate Road, 6 p.m. British Institution of Radio Engineers, North Eastern Section. "The Earth Satellite Project," by P. H. Tanner.

NORTHAMPTON.—College of Technology, 7.15 p.m. Northampton and District Electrical Association. "Rapid Transit and Suburban Railways," by B. J. Prigmore.

OXFORD. — At the Southern Electricity Board, 37, George Street, 7 p.m. I.E.E. District meeting. "The Ground and Air Control of International Civil Airlines," by A. E. Jaquemet and B. B. Clemon.

SOUTHAMPTON.—Incorporated Plant Engineers, Southern Branch. Visit to Pirelli General Cable Works, Ltd.

SWANSEA.—Demonstration Theatre, South Wales Electricity Board, The Kingsway, 6.30 p.m. I.E.S. Swansea Group. "Lighting for Photography," by R. W. Unwin.

WOLVERHAMPTON. — Wolverhampton and Staffordshire Technical College, Wulfruna Street, 7.15 p.m. British Institution of Radio Engineers, West Midlands Section. "Instrumentation of Space Vehicles," by N. R. Nicoll.

Thursday, 9th January

CARDIFF.—Demonstration Theatre, South Wales Electricity Board, The Hayes, Cardiff, 7.30 p.m. I.E.S. Cardiff Centre. "Lighting for Photography," by R. W. Unwin.

DUNDEE.—Electrical Engineering Department, Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. "The Remote and Automatic Control of Semi-Attended Broadcasting Transmitters," by R. T. B. Wynn and F. A. Peachey.

GLASGOW.—At the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, 7 p.m. British Institution of Radio Engineers, Scottish Section. "Electronic Calculator Circuitry," by F. Baillie.

LEEDS.—The University, 7.15 p.m. Leeds Metallurgical Society. "Corrosion Problems and Water Treatment in Power Stations," by R. W. Wolforth.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. "The Development of Variable-Speed High-Power Drives for Large Wind Tunnels," and "A Variable-Frequency Power Installation for Large Wind-Tunnel Drives," by P. McKearney, L. S. Drake and E. G. Mallalieu; "Speed Control of Large Wind Tunnels with particular reference to the R.A.E. 8ft × 8ft High-Speed Wind Tunnel," by L. S. Drake, J. H. Fox and G. H. A. Gunnell; and "Data-Setting and Electrical Control Gear for the Flexible Nozzle and Diffuser of a High-Speed Wind Tunnel," by C. R. Dunham.

SWANSEA. — Conference Rooms, South Wales Electricity Board Showrooms, The Kingsway, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. "Electrical Floor Warming," by J. W. Moule and W. M. Stevenson, and "Development of Transportable Thermal-Storage Space Heaters," by E. Bates.

Friday, 10th January

ABERDEEN. — Robert Gordon's Technical College, 7.30 p.m. I.E.E. North Scotland Sub-Centre. "The Remote and Automatic Control of Semi-Attended Broadcasting Transmitters," by R. T. B. Wynn and F. A. Peachey.

BELFAST.—Grand Central Hotel, 7.15 for 7.45 p.m. I.E.E. Northern Ireland Centre. Dinner and dance.

BIRMINGHAM.—I.E.S. Birmingham Centre. Annual dinner.

CREWE.—Royal Hotel, 7.30 p.m. A.S.E.E. Stoke and Crewe Branch. Open discussion on 13th Edition of the I.E.E. Regulations.

EDINBURGH.—Grosvenor Hotel. I.E.S. Edinburgh Centre. Annual supper and buffet dance.

GLASGOW. — I.E.S. Glasgow Centre. Luncheon meeting.

LONDON.—Caxton Hall, Westminster, 6.30 p.m. E.P.E.A. Southern Meter Engineers' Group. "Design and Manufacture of an Electronic Clock," by M. E. Harper.

1, Birdcage Walk, Westminster, S.W.1, 6 p.m. Institution of Mechanical Engineers. "The Design of Lightweight Marine Gas Turbines for Electric Generator Drive," by A. W. Pope, and "Methods of Measuring Stresses in Turbine Blades on Test Bed and in Flight," by D. A. Drew.

MANCHESTER.—University of Manchester, 6.45 p.m. Institute of Physics, Manchester and District Branch. "Contact Electrification," by Dr. P. S. H. Henry.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) will be obtainable after 8th January from the Patent Office, 25, Southampton Buildings, London, W.C.2

1953

10798. National Research Development Corporation.—Multiplying arrangements for electronic digital computing machines. 13th April, 1954. (788927.)

20370. General Electric Co., Ltd., Hill, R. T. J., and Warren, G. W.—Manufacture of screens, more particularly for cathode-ray tubes. 22nd July, 1954. (788722.)

26605. General Electric Co., Ltd., and McKeag, A. H.—Luminescent materials. 24th September, 1954. (788723.)

33617. Standard Telephones & Cables, Ltd.—Automatic telecommunication exchanges. 26th November, 1954. (788929.)

1954

647. Ferguson Radio Corporation, Ltd.—Automatic gain control circuits for television signal amplifiers. 20th December, 1954. (788851.)

1588. Isopad, Ltd., and Reik, H.—Electrical heating of vessels and pipes. 19th January, 1955. (788900.)

11625. Ellenberger & Poensgen Ges.—Thermally responsive electric switches. 22nd April, 1954. (788654.)

12487. British Thomson-Houston Co., Ltd.—Electric discharge lamps. 29th April, 1954. (788655.)

14053. Licentia Patent-Verwaltungs-Ges.—Electric motors and generators with noise suppression. 13th May, 1954. (788656.)

16956. Edison Swan Electric Co., Ltd.—Plug-in type electrical components. 11th May, 1955. (788853.)

21281. General Electric Co.—Pivoted flat-iron handles. 21st July, 1954. (788857.)

22051. Quarzlampen Ges.—Electric discharge lamp arrangement. 28th July, 1954. (788658.)

23932. General Electric Co., Ltd., Bate, H. C., and Bowtell, J. N.—Electroluminescent devices. 17th November, 1955. (788659.)

24592. Philco Corporation.—Methods of forming screen structures for cathode-ray tubes. 24th August, 1954. (788661.)

28568. Philips Electrical Industries, Ltd.—Ferromagnetic materials having substantially rectangular hysteresis loops. 4th October, 1954. (788727.)

28629. Licentia Patent-Verwaltungs-Ges.—Device for avoiding the influence of magnetic interfering fields on arc discharges in arc rectifiers. 5th October, 1954. (788663.)

30147. Ferranti, Ltd.—Delay stages for electrical pulses. 12th October, 1955. (788728.)

30466. English Electric Co., Ltd.—Electric motor control systems. 21st October, 1955. (788859.)

32942. United Kingdom Atomic Energy Authority.—Gas cooled nuclear reactors. 9th November, 1955. (788902.)

33489. Ilford, Ltd.—Control circuits for incandescent electric lamps for taking photographs. 16th November, 1955. (788921.)

34171. Westinghouse Electric International Co.—Electrostatic precipitators. 25th November, 1954. (788940.)

37179. Licentia Patent-Verwaltungs-Ges.—Arrangement for testing electric circuit-breakers. 23rd December, 1954. (788942.)

37822. Weston, D.—Automatic electric control systems for grinding mills. 31st December, 1954. (788924.)

1955

1212. General Electric Co., Ltd.—Lighting fittings. 4th January, 1956. (788860.)

2894. Linolite, Ltd.—Lampholder assemblies. 26th January, 1956. (788904.)

4087. Automatic Telephone & Electric Co., Ltd.—Arrangements for mounting electrical components. 10th February, 1956. (788666.)

4217. Siemens-Schuckertwerke Akt.-Ges.—Electrical apparatus, such as switches, relays, transformers or the like. 11th February, 1955. (788667.)

5832. Marcou, J. C. P., and Daguet, J.—Narrow band telephony system. 28th February, 1955. (788736.)

7081. General Electric Co., Ltd.—Electric circuit arrangements for supplying current to electric lamps. 8th March, 1956. (788864.)

7241. Parsons & Co., Ltd., C. A.—Sonic gas analysers. 23rd February, 1956. (788801.)

9340. Decca Record Co., Ltd.—Rotatable couplers for radar apparatus. 13th March, 1956. (788670.)

12547. Siemens-Schuckertwerke Akt.-Ges.—Dry rectifiers. 29th April, 1955. (788867.)

14544. Loblite, Ltd.—Electrical plug and socket adaptors. 23rd March, 1956. (788746.)

16916. Pirelli Soc. per Azioni.—Electric cable taping machines. 13th June, 1955. (788810.)

18508. Panelec (Great Britain), Ltd.—Electric heating installations. 27th June, 1956. (788676.)

20509. Murex Welding Processes, Ltd.—Welding electrodes. 25th July, 1956. (788952.)

21225. A. T. & E. (Bridgnorth), Ltd.—Telephone systems. 29th June, 1956. (788872.)

26465. Bendix Aviation Corporation.—Detachable electrical connections. 15th September, 1955. (788876.)

26543. Standard Telephones & Cables, Ltd.—Electromagnetic pulse counter. 16th September, 1955. (788821.)

27096. Hotpoint Electric Appliance Co., Ltd.—Manufacture of electric heating elements. 7th August, 1956. (788877.)

28112. General Electric Co.—Electrically insulating compositions. 3rd October, 1955. (788759.)

28203. Chloride Electrical Storage Co., Ltd.—Sealing and venting devices for dry charged electric batteries. 12th September, 1956. (788760.)

34008. Clarostat Mfg. Co., Inc.—Electrical resistors. 28th November, 1955. (788684.)

1956

1379. Etablissements Ducellier.—Electric ignition systems for internal combustion engines, jet engines, turbo-jet engines, boiler burners and like apparatus. 16th January, 1956. (788829.)

1472. Altass, G. W.—Electric heaters. 17th May, 1956. (788885.)

2376. Sylvania Electric Products, Inc.—Television receiver. 24th January, 1956. (788886.)

6846. Telefunken Ges.—Magnetic recording or reproducing apparatus. 5th March, 1956. (788890.)

10426. Westinghouse Electric International Co.—Electric circuit interrupters. 5th April, 1956. (788835.)

10850. Square D Co.—Control systems for electric motors. 10th April, 1956. (788702.)

12992. Western Electric Co., Inc.—Switching networks for communication systems. 27th April, 1956. (788837.)

16450. Kaiser Aluminium & Chemical Corporation.—Electrical connections between aluminium and copper conductors. 28th May, 1956. (788986.)

37996. Bendix Aviation Corporation.—Sonic transducers for fluid mediums. 12th December, 1956. (Addition to 774043.) (788990.)

38116. Weston, D.—Automatic electric control systems. 31st December, 1954. (Divided out of 788924.) (788925.)

Amended Specification

775244. Talon, Inc.—Electric toggle switch.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 11th January:—

ELAN (design). No. 750,402. Class 9. Apparatus for controlling the operation of machinery, machine tools, motors and the like by the means of electric current control; and electric switches.—H. Maecker and K. Maecker, trading as Elan Schaltelemente Kurt Maecker o. H.G., Dusseldorf, Germany. Address for service, c/o Stanley, Popplewell, Francis & Ross, 19, Buckingham Street, Strand, London, W.C.2.

MINI-NOISE. No. 763,944. Class 9. Electric cables.—Microdot Inc., South Pasadena, Cal., U.S.A. Address for service, c/o Marks & Clerk, 57 & 58, Lincoln's Inn Fields, London, W.C.2.

HILUSEAL. No. 766,443. Class 9. Electrical apparatus and instruments.—Aktiebolaget Hagglund & Soner, Ornsköldsvik, Sweden. Address for service, c/o F. J. Cleveland & Co., 29, Southampton Buildings, Chancery Lane, London, W.C.2.

BEMAS (design). No. 767,615. Class 9. Electric armatures for the dynamos and for the starters of land vehicles, aircraft and watercraft; and commutators and laminations of magnets, all for use in the manufacture of such armatures.—B.M.S. Laminations, Ltd., Reddicap Trading Estate, Sutton Coldfield, Warwickshire.

VARIO - KLISCHOGRAPH. No. 768,740. Class 9. Physical and electro-technical apparatus; optical apparatus, apparatus for transmitting pictures by wireless and by telegraphy; and parts.—Dr. Ing. Rudolf Hell, Kiel-Dietrichsdorf, Germany. Address for service, c/o Baron & Warren, 16, Kensington Square, London, W.8.

WARMICA. No. 769,523. Class 10. Electrically heated devices for warming beds.—J. Thwaites, 3, William Street, Staincliffe, Dewsbury.

BOOKS RECOMMENDED BY

ELECTRICAL REVIEW

RADIO VALVE DATA:
Characteristics of over 2,500 Valves, Transistors and C.R. Tubes
Compiled by *Wireless World*
3s 6d net. By post 4s

TELEVISION RECEIVER SERVICING
Vol. I Time Base Circuits
E. A. W. Spreadbury, M.Brit. I.R.E.
21s net. By post 22s 2d
Vol. II Receiver and Power Supply Circuits
E. A. W. Spreadbury, M.Brit. I.R.E.
21s net. By post 22s 2d

RADIO INTERFERENCE SUPPRESSION
Second Edition.
G. L. Stephens, A.M.I.E.E.
10s 6d net. By post 11s 1d

SECOND THOUGHTS ON RADIO THEORY
"Cathode Ray" of *Wireless World*
25s net. By post 26s 2d

Obtainable at all bookstalls or direct from:
The Publishing Dept., Dorset House, Stamford Street, London, S.E.1

Wavey WASHERS

Beryllium Copper "Wavey" Washers. For Electronic Components. Range 8BA to ¼. Corrosion resisting, non-damaging to components, higher resistance of "set", higher recovery of load, permanent spring action. They are fabricated from Beryllium copper, heat treated to VPN.350 minimum, Electro Plated to DTD.924, Cadmium Plated to DTD.904 and Passivated to DTD.923. Samples and price lists on request.

LEAVE IT TO **Lewis** OF REDDITCH

SPRINGS. SPRING CLIPS
PRESSWORK. WIRE FORMS
VOLUTE SPRINGS

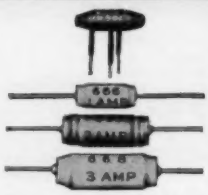
THE LEWIS SPRING CO. LTD. Resilient Works, Redditch
Tel: Redditch 720 PBX
London Office: 122 High Holborn, W.C.1 · Tel: Holborn 7470 & 7479

IN THE LEAD . . . .

. . and in the appliance

Bushing type interference suppressor of very low inductance for large motors and generators. Will suppress interference with Television and Radio reception.

Interference suppressor complying with B.S.613 and supplied to the Post Office. Suitable for suppression of interference to radio reception only.



Television interference suppressor kit for domestic electrical appliances.

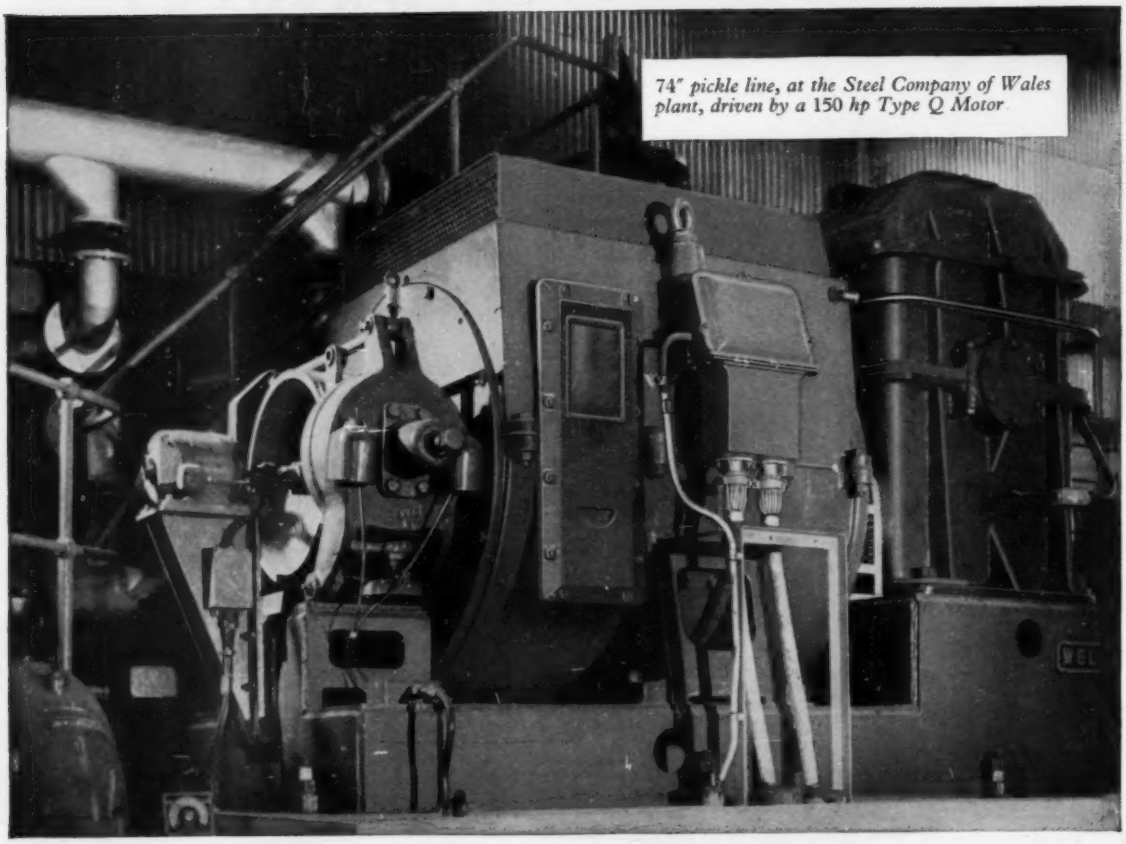
DUBILIER

CAPACITORS FOR INTERFERENCE SUPPRESSION

DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA ROAD, NORTH ACTON, LONDON, W.3
Telephone: ACOrn 2241
Telegrams: Hivoltcon Wesphone London
DN 189

Metrovick Type Q Motors

FOR DUSTY ATMOSPHERES



74" pickle line, at the Steel Company of Wales plant, driven by a 150 hp Type Q Motor

Specially designed for operation in dusty or corrosive conditions, the Metrovick Type Q totally-enclosed closed-air-circuit d.c. motor incorporates many improvements which help to simplify maintenance.

- ONE RADIATOR ONLY ON TOP OF THE MACHINE
- RADIATOR EASILY REMOVED AS A COMPLETE UNIT
- ENDBRACKETS CAN BE REMOVED, AND THE ARMATURE WITHDRAWN WITHOUT DISTURBING THE RADIATOR
- CARTRIDGE TYPE BEARING HOUSINGS
- SPLIT BEARING CAP AT THE DRIVING END
- GREASE LUBRICATORS EASILY ACCESSIBLE

METROPOLITAN-VICKERS
ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

an A.E.I. Company.

Metrovick Motors for Trouble-Free Service

J/A 706

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Director of Stores and Contracts, Postmaster-General's Department, Melbourne. 30th January. Lamps, caps and sockets. (E.S.B. 30283/57. Ten/29924.)*

Belfast.—Corporation Electricity Department. Substation batteries and electrical stores. (See this issue.)

Blackpool.—Corporation. 16th January. Pipes, poles and manhole covers and frames. (See this issue.)

Burma.—Burma Purchase Board, Rangoon. 2nd January. Fluorescent lamps and fittings. (E.S.B. 30738/57. Ten/29935.)* Lampholders and adaptors. (E.S.B. 30736/57. Ten/29932.)* 6th January. Cable and wire. (E.S.B. 30755/57. Ten/29992.)* 9th January. Enamelled wire. (E.S.B. 30963/57. Ten/29981.)* Batteries. (E.S.B. 30964/57. Ten/29982.)* Cable. (E.S.B. 30961-2/57. Ten/30037-8.)*

Colombia.—Empresa Nacionale de Telecommunicaciones, Bogota. Plastic insulated copper wire. (E.S.B. 30079/57. Ten/29955.)*

Fylde.—R.D.C. 24th January. 80 W h.p.m.v. lamps and lanterns mounted on concrete columns, in the parish of Ribby-with-Wrea. Engineer and surveyor, 29a, Station Road, Kirkham, near Preston, Lancs.

Greece. — State Procurement Service, Athens. 10th January. Telephone cable. (E.S.B. 31080/57. Ten/29984.)*

London.—Westminster City Council. 20th January. Electric lamps for one year from 1st April next. Town clerk, Westminster City Hall, W.C.2.

Londonderry.—Northern Ireland Ministry of Finance. 14th January. Electrical installation in the County Courthouse, Bishop Street.

Manchester.—Corporation. 20th January. Transformers for Davyhulme sewage works. (See this issue.)

Newbiggin-by-the-Sea. — U.D.C. 7th January. Electrical work in connection with twenty flats at Northumberland/Seaton Avenue. Surveyor, Council Offices.

Pakistan.—Posts and Telegraphs Department. 13th January. Protectors, arrestors and heat coils, etc. (E.S.B. 30426/57. Ten/29911.)*

Prestwich.—Corporation. 18th January. Electric lamps for the year ending 31st March, 1959. Borough engineer, Town Hall.

Rhodesia and Nyasaland.—Federal Power Board. 88 kV, 33 kV and 11 kV cables, auxiliary cables and accessories at Kitwe substation. (See this issue.)

Federal Tender Board, Causeway. 10th January. Telephone cable loading coils. (E.S.B. 31082/57. Ten/30041.)*

South Africa.—Stores Department, South African Railways, Johannesburg. 17th January. Copper and mica segments for armature commutators. (E.S.B. 30888/57. Ten/29976.)* Underground armoured cable and copper wire. (E.S.B. 30886/57. Ten/29997.)* Busbar mounted switchboards. (E.S.B. 30885/57. Ten/29996.)* Electric cable. (E.S.B. 30875/57. Ten/29975.)*

Johannesburg City Council. 9th January. L.v. fuse equipment and miniature circuit-breakers. (E.S.B. 30970/57. Ten/30039.)*

Uruguay.—Administración General de las Usinas Eléctricàs y los Teléfonos del Estado. 21st January. Dischargers. (E.S.B. 30511/57. Ten/29956.)* 22nd January. Isolators, circuit-breakers, insulated poles for operating circuit-breakers and isolators, tension indicating rods. (E.S.B. 30409/57. Ten/29973.)* 23rd January. Porcelain insulators, circuit-breakers, rosettes and screw-eyes. (E.S.B. 30410/57. Ten/29943.)*

Wallasey.—Corporation. 20th January. Electric cables, tungsten, sodium, fluorescent and mercury vapour lamps for the year ending 31st March, 1959. Borough engineer and surveyor, Town Hall.

Whitehaven.—Corporation. 11th January. Reinforced concrete street lighting columns, and 61 sets of street lighting equipment with 400 W high pressure mercury vapour lamps, for trunk road lighting scheme. Borough surveyor, Town Hall.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Isle of Ely.—Education Committee. Electrical installation work for second instalment of the Isle of Ely College of Further Education (£4,056).—Johnson Pearce & Co.

Newcastle-on-Tyne. — Regional Hospital Board. Electrical work at a new boilerhouse at Dryburn Hospital (£1,148).—Veale-Nixon.

Northampton.—Grammar School. Electrical rewiring and improvements (£4,485).—Electrical Installation Co.

Southport.—Corporation Lighting Committee. Recommended. Equipment for lighting schemes XII and XIII.—A.E.I. Lamp and Lighting Co. (£5,568); Stanton Ironworks Co. (£2,093); W. J. Furse & Co. (Manchester) (£1,055); and Merseyside & North Wales Electricity Board (£4,633).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Andover.—Extensions to grammar school; Maxwell Aylwin, architect, 26, West Street, Farnham.

Argyllshire.—Houses (102), on seven sites, school and three shops at Dunbeg, and extensions to schools at Ballachulish and Kilninver; county architect, County Offices, Dunoon.

Bath.—Infants' school, Twerton estate; P. Kennerell Pope, architect, 18, Brock Street.

Additional classrooms and science rooms at City of Bath Girls' School; Gerrard, Taylor & Partners, architects, 4/5, Bridge Street, Bath.

Bedworth.—Extensions to the Nicholas Chamberlaine County Secondary School (£110,575); G. R. Barnsley, county architect, Shire Hall, Warwick.

Bradford.—St. Blaise R.C. Secondary School, Rooley Lane, Bierley; J. H. Langtry-Langton, architect, 8, Oak Mount, Manningham.

Bridge-Blean.—Houses (30), Littlebourne; H. V. Godfrey, architect, 63, Oxford Street, Whitstable.

Cardiff.—Three-storey building for new Welsh College of Advanced Technology; Sir Percy Thomas & Son, architects, 10, Cathedral Road, Cardiff.

Carlisle.—Factory for British Oxygen Co., Ltd.; John Laing & Son, Ltd., contractors, Dalston Road.

Chelmsford.—County supplies depot at Widford (£200,000); Essex county architect, County Hall, Chelmsford.

Cirencester.—Physics and general science laboratories, grammar school; county architect, Shire Hall, Gloucester.

Colchester.—Extensions to Corporation Transport Depot, Magdalen Street; J. S. Orchard, borough engineer, 1, West Stockwell Street.

Colne.—Offices; A. Monk & Co., Ltd., builders, Padgate, Warrington.

Crawley.—Offices, New Town; Godman & Kay, architects, 13, North Parade, Horsham.

Croydon.—Houses, maisonnettes and flats (153), Castle Hill; borough surveyor, Town Hall, Katherine Street.

Cumberland.—Clinic and occupation centre, Wigton; county architect, Portland Square, Carlisle.

Cwmbran.—Houses (43), Court Farm site; U.D.C. surveyor.

Daventry.—Police station and court house; Northants county architect, County Hall, Northampton.

Derby.—Central kitchen for Royal Infirmary; H. A. Sandford, consulting engineer, 2, Gate Street, London, W.C.2.

Durham.—Additions to Dinsdale Park Residential School (£27,000); Brown & Dixon, Ltd., builders, Darlington.

Earl Shilton.—Houses (40), Maugham Street and King George's Way; Council's architect, Hinckley, Leics.

Eastbourne.—Dwellings (222), Sports Farm estate; borough engineer.

Edinburgh.—Reconstruction of premises, 59, Princes Street; Marks & Spencer, Ltd., 22, Argyle Street, Glasgow.

Ellesmere Port.—Maisonnettes (120), North Whitby estate; borough surveyor.

Finchley.—Flats (38), Regent's Park Road; Chessington Lodge, Ltd., 98, Baylis Road, S.E.1.

Hall for St. Mary's Parish Church, Hendon Lane; Kenneth Wood, architect, 20, Vine Road, Hampton Court.

Glasgow.—Houses (1,053), Easterhouse; director of housing, 20, Trongate.

Gosforth (Northumberland). — Private housing estate, Fawdon; William Leech, Ltd., builders, Clayton Street, Newcastle-on-Tyne.

Great Yarmouth.—Bungalows (42), Church Lane; borough engineer, 15, Regent Street.

Hainault.—Workshops, offices and stores; G. H. Miller & Co., Ltd. Sheridan Works, Thorpe Road, London, E.7.

Halifax.—Flats (54), Brunswick Street; borough engineer.

Hanwell.—Hall for St. Mary's Church, Greenford Avenue; Michael A. J. Farey, architect, 83, Prince Albert Road, London, N.W.8.

Hartlepool.—Light engineering factory, Spion Kop; Richmond Construction Co., West Hartlepool.

Hove.—Factory and offices, St. Joseph's Close; A. P. Besson & Partner, Ltd., 34/40, Ludgate Hill, London, E.C.4.

Lancaster.—Departmental store, Penny Street; Maypole Dairy Co., Ltd., Maypole House, Finsbury Square, London, E.C.2.

Leeds.—Dwellings (1,493), Burmantofts area; city architect.

London.—Office block, Fetter Lane, City; Paterson & Dickinson, Ltd., builders, Westmoreland Road, N.W.9.

Houses, College Road, Dulwich; Sir Robert Tasker & Partners, architects, 3, Field Court, Gray's Inn, W.C.1.

C.E. school, Camden Street, St. Pancras; Thomas F. Ford, architect, 189, Victoria Street, S.W.1.

Offices, 11/12, Arlington Street, St. James's; T. P. H. & E. Braddock, architects, 14, Great Smith Street, S.W.1.

Flats and maisonnettes, Somers Road,

Brixton; Clifford Culpin, architect, 39, Doughty Street, W.C.1.

Rebuilding premises, 72-78, Lewisham High Street, for Boots Pure Drug Co., Ltd.; C. St. C. Oakes, chief architect, Station Road, Nottingham.

Houses (114), laundries, workshop, etc., on the Astley Street site, for Camberwell Housing Committee; Wates, Ltd., building contractors, 1258, London Road, Norbury, London, S.W.16.

Luton.—Bungalows (52), Fieldgate Road; Pearce & Barker, builders, 71, Leagrave Road.

Maldon.—Extensions to the grammar school (£47,000); H. Conolly, Essex county architect, County Hall, Chelmsford.

Manchester.—Flats (66), Wilmslow Road, Didsbury; J. H. Smith (Hale), Ltd., builders, 15, Cross Street, Altrincham.

Aged persons' home, Blackley; city architect, P.O. Box 488, Town Hall.

Middlesbrough. — Art gallery; borough engineer.

Newton Abbot.—Factory, Forde Road; Henry J. Cordwent, Ltd., Queen Street.

North Riding.—Additions to children's home, and erection of two further homes (£11,000); H. J. Knowles, county architect, Northallerton.

Northumberland.—Infants' school at Morpeth (£23,000); county architect, County Hall, Newcastle-on-Tyne.

Nuneaton.—Works extensions; Premier Artificial Stone Co., Ltd., Chapel End.

Oldbury.—Dwellings (37), Harvington Road; borough surveyor.

Oxford.—Extensions, Radcliffe Infirmary; J. F. Watkins, architect, 38, Queen Square, High Wycombe.

Pontefract.—Extensions to King's School (£70,000); J. G. Poulson, architects to West Riding C.C.; Ropergate, Pontefract.

Redruth.—Factory extension; Mace, Rainbow & Son, Ltd., Ormdale, New Portreath Road.

Richmond (Yorks).—Fourteen houses at Brompton-on-Swale for R.D.C.; R. H. Thistlethwaite, builder, Leyburn.

Romford.—Houses (242), Harrow Crescent and flats (73), Prospect Place; J. Twinn, town clerk, Town Hall.

Rothwell.—First stage of factory; Groocock & Co., Ltd., Rothwell Works.

Royton.—Aged persons' dwellings (28), warden's house, communal baths and communal rooms, Luzley Brook, for U.D.C.; Heywood & Ogden, architects, 12, Clegg Street, Oldham.

Rutland.—Junior school at Great Casterton (construction to commence about mid-1958); county architect, Oakham.

St. Albans.—Works extensions for Gibbs & Bamforth, Ltd., Spencer Street; Y. J. Lovell & Son, Ltd., builders, Marsham Lane, Gerrards Cross.

Somerby.—Housing block for Melton and Belvoir R.D.C.; F. W. Keyworth, architect, Asfordby Road, Melton Mowbray.

Somerset.—Erection of Taunton Municipal College; R. O. Harris, county architect, Park Street, Taunton.

Southampton.—Flats (112), Wimpson Lane; Dor Properties (Bournemouth), Ltd., Cheam House, Exeter Road, Bournemouth.

South Shields.—New factory, Bede trading estate; Screening, Crushing & Engineering Co., Ltd.

Stanley (Co. Durham).—Houses (120) for U.D.C.; direct labour.

Sunderland.—Four family group homes (£16,000); T. Stewart, builder, 37, The Westlands, Sunderland.

Extensions to Sunderland Technical College (£351,000); borough architect, Grange House, Stockton Road.

Proposed hostel for the T.C. (£15,000); direct labour.

Swindon.—Further stages of the Princess Margaret's Hospital (£1,268,000); Oxford Regional Hospital Board, 43, Banbury Road.

Thorpe-le-Soken. — Secondary modern school; Joseph Moss & Sons, Ltd., builders, St. Helena Road, Colchester.

Trowbridge.—College of Further Education; T. Holdoway & Sons, Ltd., builders, Station Road, Westbury.

Twickenham.—Fire station for Middlesex C.C.; Prestige & Co., Ltd., builders, 149, Grosvenor Road, London, S.W.1.

Tynemouth.—Houses (102), Preston Road estate; J. H. James & Son, builders, Archer Street, Wallsend.

Warwick.—Dwellings (30), West End; Jackson & Edmonds, architects, 116, Colmore Row, Birmingham.

Washington (Co. Durham).—Houses (71), Coach Road estate, for U.D.C.; Cussins, Ltd., contractors, The Drive, Gosforth.

Watford. — Factory, Holywell estate; Abrasive Blades, Ltd., 182, Rickmansworth Road.

West Hartlepool.—Proposed Grange County School for the E.C.; A. G. Sinclair, borough architect.

Fire station (£40,000); W. W. Brazell, Ltd., builders, Raeburn Street, West Hartlepool.

Whitefield.—Houses (70), Elms estate; Middleton & Co., Ltd., builders, Bank Street Sidings, Blackpool.

Wolverhampton.—Dwellings (132), Willenhall Road North; borough surveyor.

York.—Dwellings (108), Long Close Lane; city architect.

Catalogues and Lists

AIR FILTRATION.—Illustrated catalogue (B5713) describing the "Rollotron" air filtration unit.—**Air Control Installations, Ltd.,** Ruislip, Middlesex.

DUST COLLECTION PLANT.—Illustrated brochure (72) describing briefly the range of dust collection and control plant manufactured by the Gas Cleaning Division of the company.—**W. C. Holmes & Co., Ltd.,** Tunbridge, Huddersfield.

ELECTRICAL CONDUCTORS. — 84-page reference book entitled "Electrical Conductors—International Standard Sizes" which contains in tabular form a comprehensive collection of data relating to electrical conductors much of it hitherto unpublished. —**British Insulated Callender's Cables, Ltd.,** 21, Bloomsbury Street, London, W.C.1.

GENERATING SETS.—Two leaflets describing diesel-electric generating sets in ranges from 4 to 175 kVA and arc-welding diesel-generating sets.—**Grahame Puttick, Ltd.,** Ash, Canterbury, Kent.

INTERFERENCE SUPPRESSION.—Nine-page catalogue (952) dealing with the range of components for radio interference suppression produced by the company.—**Plessey Co., Ltd.,** Ilford, Essex.

LIGHTING FITTINGS.—Brochure illustrated in monochrome and colour giving particulars of a new range of light-construction decorative wrought-iron pendants, wall brackets and lanterns.—**Stephen Glover & Co.,** Intown, Walsall.

48-page catalogue (807/57) giving particulars of decorative lighting fittings together with a separate leaflet showing the purchase-tax applicable to these fittings.—**Falk, Stadelmann & Co., Ltd.,** 91, Farringdon Road, London, E.C.1.

Brochure illustrated in colour and describing additions to the company's range of decorated glassware.—**George Forrest & Son, Ltd.,** Osborne Road, London, W.3.

MEASURING INSTRUMENTS.—Five descriptive leaflets dealing with electrostatic voltmeters, "Inkwell" minor graphic instruments, a.c. leakage indicators, auto-photometers and process timing devices.—**Everett Edgcumbe & Co., Ltd.,** Colindeep Lane, London, N.W.9.

SPACE HEATING.—Six booklets and leaflets dealing with the various types of space heating equipment, etc., produced by the company.—**Dimplex, Ltd.,** Millbrook, Southampton.

SWITCHGEAR.—Leaflet (F.T.P.1) illustrating and describing high voltage outdoor fault throwing switches for use on systems up to 132 kV.—**Line Equipment, Ltd.,** 32, Queen Victoria Street, London, E.C.4.

TEST PLANT DRIVES.—Booklet (PS/130) illustrating typical test plant drives which have been supplied by the company.—**English Electric Co., Ltd.,** Electrical Plant Sales Department, Stafford.

TIME RECORDERS.—Leaflet illustrating synchronous a.c. electric time recording machines available from the company.—**Office Systems Co.,** Avondale Road, Coventry.

VARIABLE SPEED DRIVES.—Illustrated brochure describing the Lancashire-Nevelin "Varionic" variable speed drives.—**Lancashire Dynamo Nevelin, Ltd.,** Hurst Green, Oxted, Surrey.

WINDING MACHINES. — Illustrated brochure describing various types of bobbin, coil, and transformer winding machines.—**Frank Whitelegg, Ltd.,** 304, High Street, Sutton, Surrey.

Two leaflets dealing with "Aumann" coil winding machines and the "Twist Tool" which enables the reinforcing of tappings to be carried out while the winding is still held in the machine.—**R. H. Cole (Overseas), Ltd.,** 2, Caxton Street, Westminster, London, S.W.1.

WIRING EQUIPMENT.—116-page illustrated and priced catalogue dealing with the range of cables, conduit and conduit fittings and other wiring material distributed by the company.—**Alliance Wholesale, Ltd.,** 240/250, Ferndale Road, London, S.W.9.

Street Lighting Schemes

Street lighting schemes which **Eastbourne** Highways and Drainage Committee recommends should be included in the estimates for 1958-59 are fluorescent lighting in King Edward's Parade, Grand Parade and part of Marine Parade at an estimated cost of £3,500; and colour corrected mercury lighting in part of Meads Road at a cost of £1,800.

Hebburn (Co. Durham) U.D.C. has approved the spending of a further £6,500 on improvements to street lighting including the conversion of existing mercury vapour lighting to sodium.

Chester Improvements Committee has recommended that the city surveyor shall obtain tenders for the re-lighting with sodium lamps of Saughall Road, from Stone Bridge diversion to the city boundary, at a total estimated cost of £7,375.

At a meeting of the **Ennerdale (Cumberland)** R.D.C. reference was made to complaints about certain parts of the rural area having inadequate street lighting. Councillor Collighan stated that the Council had spent more than £17,000 providing electric street lighting in the parishes in its area. It was intended eventually to change over all lighting from gas to electricity.

Manchester Highways Committee reports that street lighting in Royle Green Road, Northenden, is to be converted from gas and tungsten to sodium lighting.

Margate Works Committee has agreed in principle to the use of fluorescent lamps in future street lighting installations, with certain exceptions. The borough engineer has been instructed to prepare a full report.

Walsall Public Works Committee recommends the erection of 100 electric street lamps in various residential roads at an estimated cost of £8,000.

So many activities which depend on electrical power depend also on P & G. From railways to telephones, there is hardly any sphere in which P & G is not used.

P & G Batteries are first choice for switch closing, switch tripping, emergency lighting, standby power supply, supervisory control.

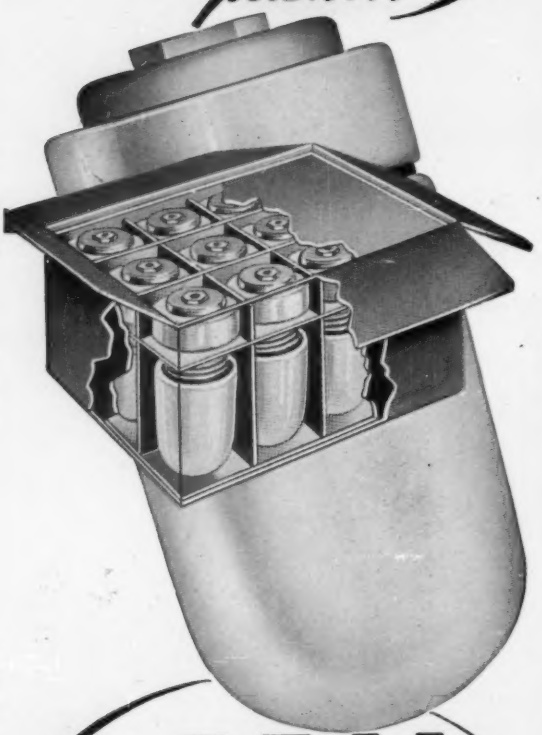
PLEASE SEND FOR DESCRIPTIVE BOOKLET TO:

PRITCHETT & GOLD and E.P.S. CO. LTD., 137 VICTORIA STREET, LONDON, SW1

(BATTERY MAKERS SINCE 1882)

PG1

a R.E.A.L. pack...



...for a R.E.A.L. Watertight fitting

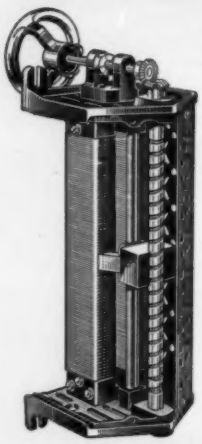
Patent No. 568702

Buy your fittings by the dozen, in this rail-certified container, and lift them out in perfect condition . . . . Nothing broken . . . . no lost rubber rings or lampholders . . . . no straw-covered glasses to clean. R.E.A.L. Watertight Fittings arrive as YOU want them, because they are packed this way.

Probably the use of R.E.A.L. non-corrodible watertight fittings is standard practice with you; in which case you already know that erection cost is shillings less than ordinary — and ordinarily packed — watertight fittings.

Issued by Rowlands Electrical Accessories Ltd., R.E.A.L. Works, Birmingham 18

Consult Birch
REGISTERED TRADE MARK
for
VARIABLE RESISTORS



Slate wound Resistors of fixed and variable type, incorporating oxidised nickel copper wire to B.S.S. 115.

Write for List No. 100

and for:

Asbestos Woven Mats
Loading Resistors
Motor Operated Resistors
Strip Heating Elements
Stud Type Resistors
Toroidal Resistors

VITREOUS ENAMELLED RESISTORS

Ferrule or wire end type: full range of 24 sizes—1¼-250 watts. (List VE 190).

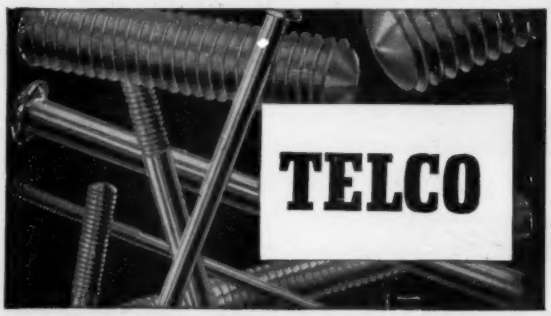
Birch
REGISTERED TRADE MARK

H. A. BIRCH & CO. LTD.
WOOD STREET, WILLENHALL, STAFFORDSHIRE
Telephone WILLENHALL 494 · 495 · Grams WILOHM WILLENHALL
LONDON OFFICE: 1-5 NORTHOLT ROAD, HARROW, MIDDLESEX
Tel.: BYRON 5120

HOUSE SERVICE METERS

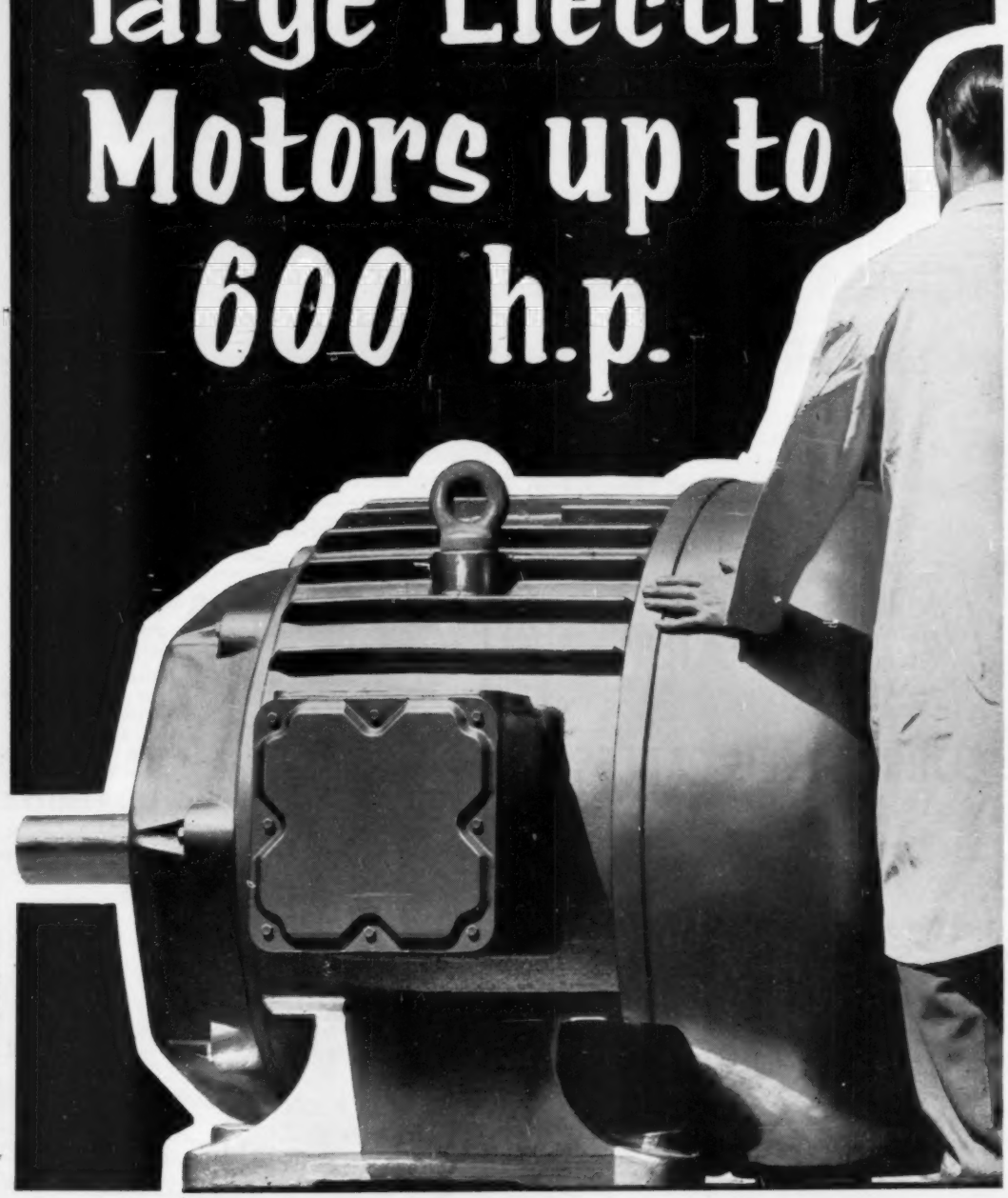
Credit Pattern and Prepayment Type
200-240 v. A.C. S/Ph 50 c. (& D.C.)
AVAILABLE FROM STOCK
POLYPHASE 400-440 v. 3-Wire Type
Ex Stock

UNIVERSAL ELECTRICAL CO.
217-221 City Road, London, E.C.1



Studding · Studs · Allthreads · Tie Rods
TELCO LTD., 3 Newman Street, London, W.1 MUSeum 5701/4

BROOK for large Electric Motors up to 600 h.p.



BROOK MOTORS LTD., HUDDERSFIELD, ENGLAND

57/10

This is

Wandleside Cable Works Ltd.

announcing

"HORTIWARM"

A complete system of Soil-warming, Air-heating and Ventilation designed for:—

GLASS HOUSES AND FRAMES

Equally adaptable to the requirements of the Commercial Grower and the Small Nurseryman

Employing the well-known and proved

FLORAWARM AND CORRUSTEEL CABLES

Ask for leaflet

Send your enquiries direct, or through your Local Electricity Board or Electrical Contractor to

WANDLESIDE CABLE WORKS LIMITED

106 Garratt Lane, Wandsworth, London, S.W.18

Telephone: BATtersea 2273/7 Telegrams: "Wandleside London"

Sheen CABLE JOINTING EQUIPMENT

the first choice for reliability

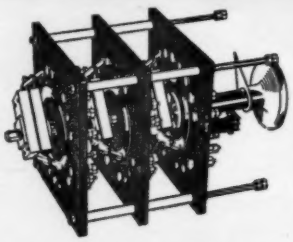
Manufactured by

HUGH PRICHARD & CO.(Nottm.)LTD.

Queen Street · Old Basford · Nottingham

Telephone – Nottingham 74373

H.B. TRANSFORMER TAPPING SWITCH TYPE L



Interlocked with micro break switch

Pull Handle to release Lock, then turn

Also Type O without interlock and Type C for on load switching

SINGLE OR MULTI POLE

Phone: Kings Norton 1604

HENLEY BURROWES & CO. LIMITED

Factory Centre: KINGS NORTON, BIRMINGHAM

METAL SPINNINGS by LEE AND WILKES LTD

IN ANY METAL UP TO 7 FEET DIAMETER

SANE PRICES: DEPENDABLE DELIVERIES: QUALITY PRODUCTS

LEE AND WILKES LTD

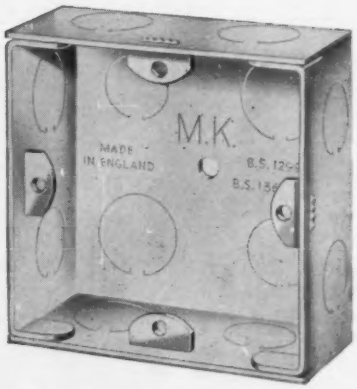
BREWERY ST. BIRMINGHAM 6

A.I.D. APPROVED

MK 141 DHB

TAKE A SOCKET . . . PLUS A SWITCH . . . PLUS A PILOT LAMP

ADD MK INGENUITY AND THEY ALL GO INTO A BS 1363 BOX!



THESE NEW PILOT-LIGHT SWITCHSOCKETS are so compact that they fit into the standard BS 1363 box with ample room for wiring on a ring circuit and looping to a spur if necessary. This is made possible by careful designing and the use of a miniature neon lamp. The lamp is complete with a resistance and uses a negligible amount of current. Replacement is easily made if necessary, but the normal life of the lamp is very long.

Flush patterns are available with insulated plates finished brown or ivory and with brass plates finished BMA or matt chrome.

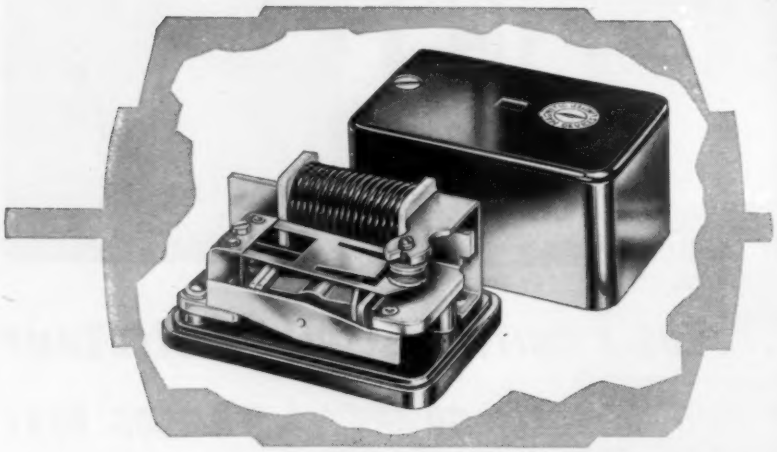
Surface metalclad units of equivalent dimensions are also available with steel frontplates finished aluminium stove enamel or brass frontplates finished BMA.

Write today for full details of this useful and competitive new range.

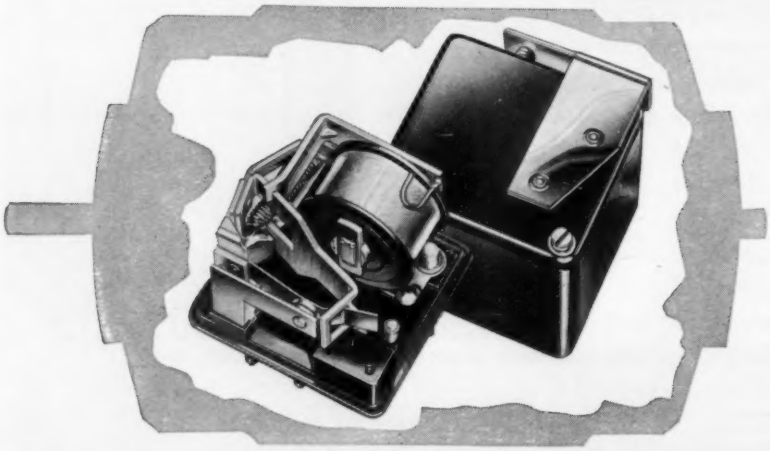
MK .... the mark of leadership

M. K. Electric Limited, Wakefield Street, London N.18 *Edmonton 5151*

F.H.P. motor starting



The Series 311 Relay replaces the centrifugal switch to bring in the start winding. This relay has single pole normally open contacts and works with a small current differential. Coil windings are available to suit current ratings of 0.5 to 10 amperes. The relay may be mounted in any position and different types of mounting brackets can also be supplied.



The Series 310 Relay is also produced as an alternative to the centrifugal switch for capacitor start motors. Here the relay coil is connected in parallel with the start winding and has single pole normally closed contacts. As the motor runs up to speed the relay is pulled in by the rise in voltage across the start winding. Two spare terminals are available as connecting points for other leads. The relay can be supplied for motor ratings up to 250 volts A.C.

Magnetic Devices LTD.
A.I.D. AND A.R.B. APPROVED

MAGNETIC DEVICES LIMITED

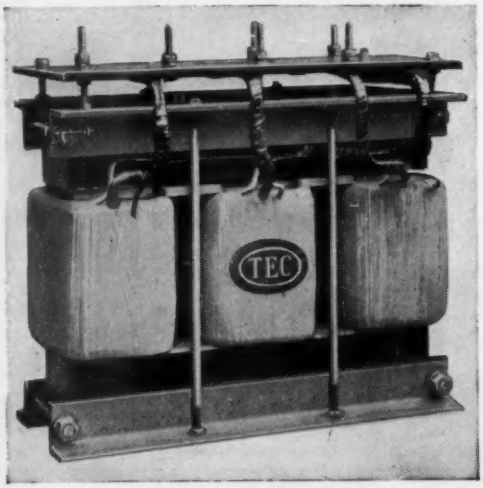
MD 22

MAGNETIC DEVICES LTD., EXNING ROAD, NEWMARKET, SUFFOLK
Telephone: Newmarket 3181/2/3. Grams: Magnetic Newmarket.

Insist on

T.E.C.

5 V.A.-100 K.V.A. TRANSFORMERS AND CHOKES



THREE PHASE OPEN TYPE. 5 K.V.A.-50 K.V.A.

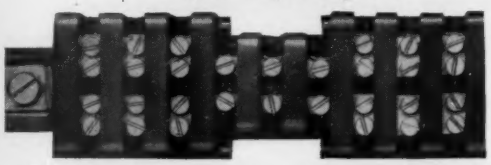
Full Catalogue on request:—

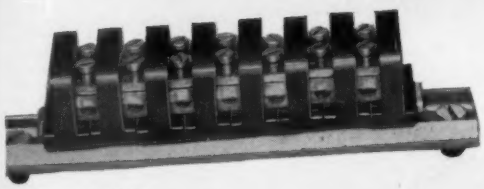
The TRANSFORMER & ELECTRICAL CO. LTD.
HONYWOOD RD., BASILDON, ESSEX
Telephone: Basildon 20491/3

"Colne" **CONNECTORS**

Range 25 to 50 ampere capacity. Unit build up from 2 way to 26 way strips, in either 25 amp., 50 amp. or mixed assemblies.

We invite your enquiries.





Manufactured by

Colne

SWITCHGEAR (K & W) LTD.
formerly Electrical Products (Colne) Ltd.
Walton Street, Colne, Lancs.
Phone: Colne 1394/5

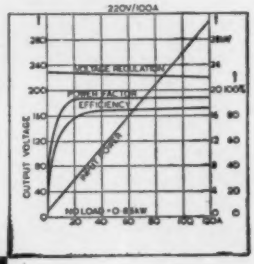
Electronic Rectifiers for industrial and laboratory use

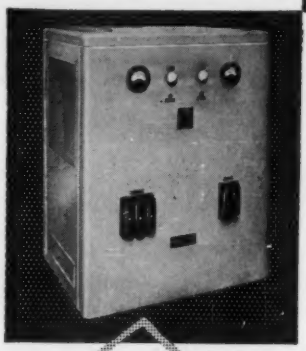
500W to 75kW all with single anode mercury vapour bulbs

All rectifiers in Philips wide range are noted for:—

- ★ **High efficiency and long life with single anode mercury vapour bulbs;**
- ★ **low initial cost;**
- ★ **reliable service with minimum attention, due to absence of moving parts.**

Rectifiers can be constructed to individual requirements or to fit into existing site conditions. If you would like our technicians to visit your premises and advise you without obligation, or if you require further details of our range of rectifiers, please write to address below.





General characteristics of a typical Philips Rectifier can be seen from the graph above, showing a rectifier designed to operate from 3-phase supply and giving up to 100 amps at 220/230 volts DC.
The curves indicate:

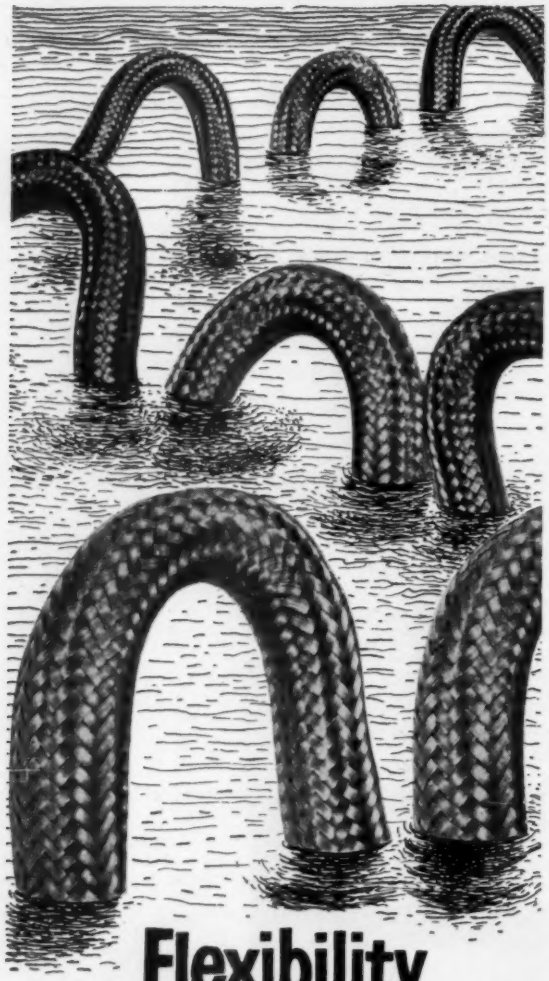
(a) Excellent voltage regulation obtained from light load up to overload.
(b) Maintenance of high efficiency even at partial load.
(c) Small 'no load' loss.
(d) High power factor, well maintained at partial loads.

Research and Control Instruments Division

PHILIPS **ELECTRICAL LTD**

INDUSTRIAL PRODUCTS DIVISION

CENTURY HOUSE · SHAFTESBURY AVENUE · LONDON · WC2
(PR1008)A



Flexibility

. . . and strength—these are the particular characteristics of Sparklets Wire Braiding. And over 50 years' specialisation in braiding wire for all purposes in a wide range of diameters and widths has taught us most of the answers. If you have a braiding problem, we should be glad to hear about it.

SPARKLETS
wire braiding
SPARKLETS LTD - DEPT. WD - QUEEN ST - TOTTENHAM, N.17

M^cGEOCH

INDICATOR LIGHT · · · FITTINGS
and
MULTI-LIGHT UNITS
to Customers' requirements

Registered Est'd M G 1832 *Trade Mark*

also makers of —
SWITCH and FUSE GEAR
CONTROL PANELS and CUBICLES
WATERTIGHT SOCKETS and PLUGS
LIGHTING FITTINGS, LAMPHOLDERS

WILLIAM M^cGEOCH & CO. LTD. (Dept. R.E.)
BORDESLEY, BIRMINGHAM 10, also GLASGOW and LONDON

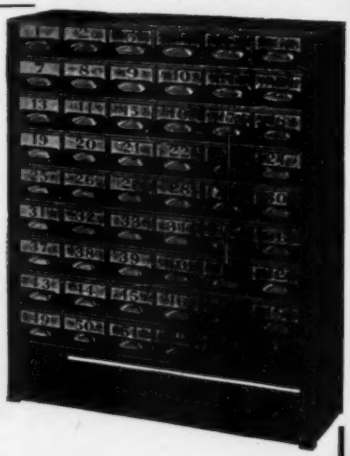
THE **"54"** DRAWER UNIT

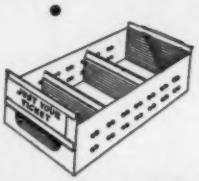
ALL STEEL
Stove Enamelled
BRONZE GREEN

•

OVERALL SIZE
42" HIGH
36" WIDE
12" DEEP

•





Contains 54 of these drawers, each 5" wide, 3" high, 11½" long. 54 dividers and 54 drawer cards with each unit. Extra dividers 6d. each.

£18
DELIVERED FREE U.K.
SEND FOR SAMPLE DRAWER

N. C. BROWN LTD.

ROCHDALE ROAD WORKS, HEYWOOD, LANCS
Telephone: 69(W8/9 3 lines)

Measurement

single disc polyphase meter

1. In its neat bakelite insulated case the most compact meter on the market.

2. Half the size and weight of three disc type.

3. High torque weight ratio.

4. Negligible interaction.

5. Torque balance and all other adjustments readily accessible.

6. Anisotropic brake magnets giving maximum stability.

7. Outsize performance that makes it just right for your requirements.

Measurement Ltd

(A Member of the Parkinson & Cowan Group)

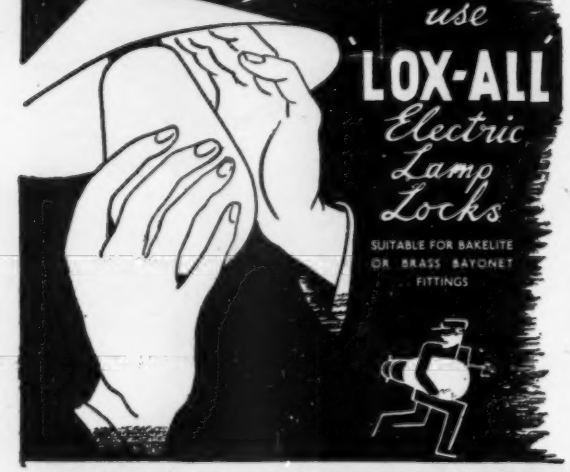
Tameside Works, Dobcross, Nr. Oldham.
Tel. Nos. Delph 284 & 291/2.

Export enquiries to Parkinson & Cowan Group Exports Ltd., Terminal House, Grosvenor Gardens, London, S.W.1.
Tel. Nos. SLOane 0111/4. Cables: DISC, London.

ABBOT BROWN & SONS, LTD.

SCALES · DIALS · CALCULATORS · RULES · INSTRUCTION & NAMEPLATES

STOP "lightfingers"



use

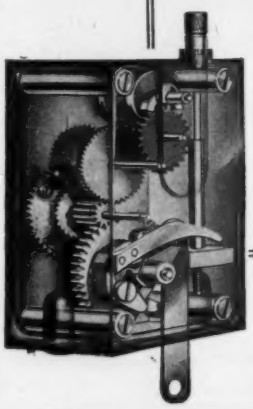
LOX-ALL Electric Lamp Locks

SUITABLE FOR BAKELITE OR BRASS BAYONET FITTINGS

OBTAINABLE FROM ALL LEADING WHOLESALERS

Write CHECKLOX 4 Tokenhouse Buildings, Kings Arms Yard, Moorgate, London, E.C.2

Phone: MONARCH 1164



MEETS THE NEED FOR A BETTER TIME LAG

This is the "VAR", a Rotherham Time Lag very much in favour with Engineers who demand the highest standards of accuracy in delayed-action Timing mechanism. It is one of a series of Rotherham instruments, which, for precision performance and absolute dependability has won world-wide preference.

Full information on Rotherham products, including the following are yours for the asking: Time Lags, Instruments, Recording Clocks, Process Timers, Pressure Gauge Movements, Small parts for Engineering, such as Taps, Oil and Grease Cups, Oil Indicators, Unions, Nipples and Olives.

Rotherhams OF COVENTRY

ROTHERHAM & SONS LTD.
Telephone COVENTRY 64154

PRECISION MANUFACTURERS SINCE 1750

WASHERS LTD.

93 · IRVING STREET
BIRMINGHAM 15
MIDLAND 1423

MEKELITE

GEARED JOINT

INDUSTRIAL LIGHTING UNITS

For wall, bench or machine mounting. Catalogue sent free on request.

MEK-ELEK Engineering Ltd., 17 Western Road, Mitcham, Surrey. MITcham 3072.

CABLES are our business

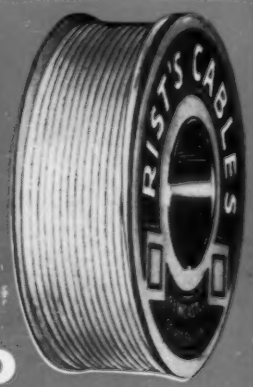
consult RIST'S now!

ELECTRONICS

FACTORY MAINTENANCE

ELECTRICAL INDUSTRY

MINING



In addition to our wide range of cable manufacture, we specialise in the production of cable assemblies, leads and cords.
Write for our illustrated catalogue

RIST'S WIRES & CABLES LTD
LOWER MILEHOUSE LANE · NEWCASTLE · STAFFS

For lighting that is streets ahead

More light—less maintenance, that's what many public authorities are proving in the streets with the '*Golden Ray*' and this is the reason why they specify this *High Performance Lantern* when existing lighting schemes are extended or modernised.

The '*Golden Ray*' has high optical performance obtained by a specially designed prismatic cutting of the 'Perspex' refractor panel. The low maintenance cost is derived from its extremely practical design and careful choice of materials.

The top is die cast from corrosion resisting Aluminium Alloy. The refractor panel is hermetically sealed to the inner surface of the 'Perspex' enclosing bowl. Between the bowl and the top casting there is a heavy felt gasket, thus excluding all dirt and dust. Hinge pins and toggle fastenings are all manufactured in stainless steel.

This lantern is especially designed for use with 85 or 140 watt *sodium discharge lamps.* It can also be supplied in a smaller version for use with 45 or 60 watt sodium lamps.

The '*Golden Ray Mark III*' is available for both side or top entry.

Now, control gear can be supplied in the canopy if required . . .

The recently introduced Golden Ray Mark VI presents a further development. Similar in appearance to the Mark III — provision has been made in the canopy for the installation of control gear.

THE 'GOLDEN RAY MARK III' has been installed by many authorities throughout the British Isles. Recent installations include:—

Croydon · Walthamstow · Leeds · Luton St. Albans · Glasgow · Leicester · Sheffield Wandsworth · Manchester.

For literature and further information write to :—

Engineering and Lighting Equipment Co Ltd

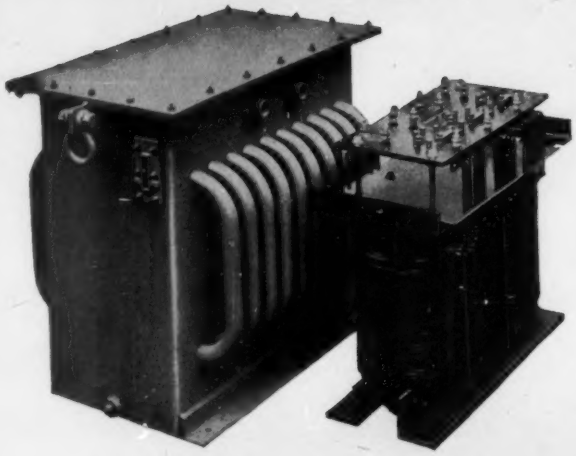
ELECO

Sphere Works, St. Albans, Herts

Telephone : St. Albans 54524/5/6

WILLESDEN
TRANSFORMER COMPANY LTD.

Air Cooled and Oil Immersed Transformers up to 250 kVA for . . .
Electronic Circuits
Rectifiers
Furnaces
Lighting and Power
Phase Conversion



A solution to your Transformer problems

Our Technical Sales Dept. is always at your service for consultation and quotations

MANOR PARK WORKS, MANOR PARK ROAD, LONDON, N.W.10 Elgar 5445-6

THE NEW INDESTRUCTIBLE
TEST LAMP

SUPPLIED WITH INTER-CHANGEABLE STEEL PRONGS ANGLED AND STRAIGHT

Electrical Engineers will find the new modified Test Lamp indispensable. The interchangeable prongs housed in the carrier band allow the Test Lamp to be used for every purpose and circumstance. The Lamp is housed in moulded rubber with Perspex case. Supplied with 4 ft. of 6 m.m. H.T. cable and H.R.C. fuses in prod.
100-500 Volts. A.C.-D.C.

PRICES
TYPE MTL 3 (illustrated)
35/-
TYPE MTL 1 with fixed prods
30/-
Special Terms to Wholesalers and Large Buyers

JOHN DRUMMOND (ENGINEERS) LTD.
Bellcrag Works, Dalsholm Road, GLASGOW, N.W. Tel.: MARyhill 3315

BUSHES

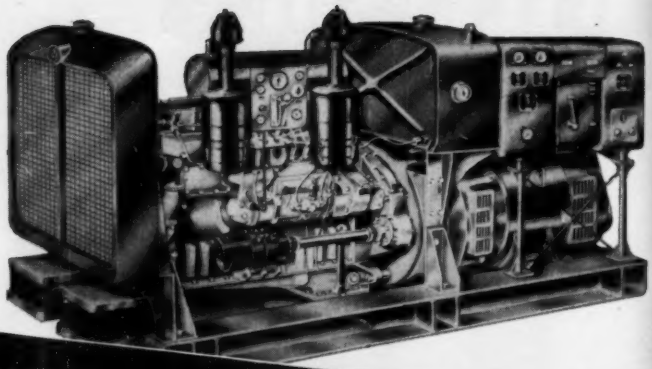
A full range of sizes and threads
Conduit
B.S.P.
26 T.P.I.

Litholite
Plastic Moulders since 1901

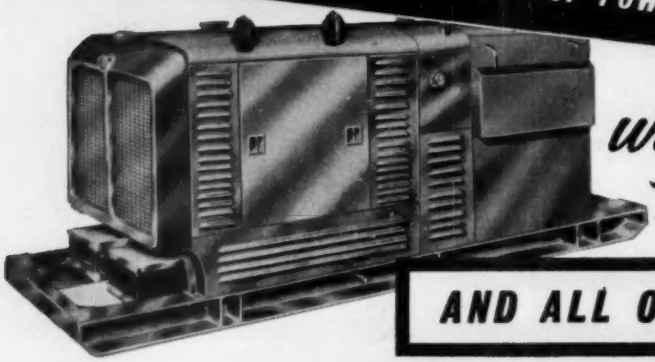
LITHOLITE Insulators & St. Albans MOULDINGS LTD.
Sandown Road, WATFORD, Herts. Tel. WATFORD 4494

MEADOWS

now introduce



THE MOST COMPREHENSIVE RANGE OF POWER UNITS AVAILABLE TODAY



with 5000 variants to choose from...

AND ALL OF THEM STANDARD!

Based on the six well proven Meadows diesel engines, a new range of Power units is now available, providing generating sets from 22-161 kW and power packs from 35-235 S.H.P.

Maximum interchangeability of components and world wide spares and service facilities through a network of agents ensure a long life of trouble-free operation.

DOMINANT FEATURES:

Low prices and higher outputs give reduced cost per k.W.

Adaptability to virtually any specification by selection from a wide range of variants.

Extended power range and consolidated range of outputs.

Unit construction for maximum economy in assembly and interchangeability of components.

More competitive through a wide use of standard proprietary components.

Common set and engine components allow a wide degree of interchangeability throughout range.

Virtually any make of generator may be incorporated in the sets.

Sets available from bare power plants to completely self-contained trailer mounted fully canopied units.

You've a specification? - It will surprise us if we can't meet it!

Write now for fully illustrated and comprehensive free literature on the New Range.

HENRY MEADOWS LIMITED

ELECTRICAL EQUIPMENT DIVISION,

FALLINGS PARK, WOLVERHAMPTON

Telephone: Wolverhampton 31921

Telegrams and Cables: OUTPUT, Wolverhampton

London Office: 37/41 BEDFORD ROW, LONDON, W.C.1 HOLBORN 6881/5

AN ASSOCIATED BRITISH ENGINEERING COMPANY

MID 74

..... had a *Cosmocord* testing day.

The things they did to me! Weighing, measuring, being looked at through microscopes. Calipers all over the place (and I'm so ticklish).

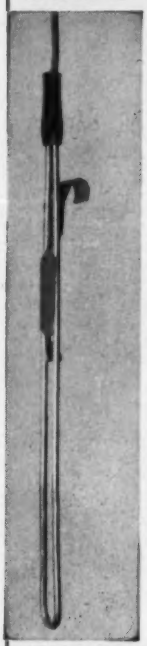
Talk of the 'Eleven plus', it's child's play compared to being passed by Cosmocord. I suppose that's how they turn us out so well.

But take my tip, if you are a piece of plastic, and you want an easy life

don't get moulded by **COSMOCORD**

COSMOCORD LTD WALTHAM CROSS HERTS TEL: WALTHAM CROSS 5206 (London subscribers please dial WA4 5206)

DON'T WAIT FOR THE FROST



GET YOUR

ELTRON ANTI-FREEZE HEATER

NOW

PRICE **38/-**

SEND FOR LEAFLET No. 956

ELTRON (LONDON) LTD.

STRATHMORE ROAD, CROYDON

Telephone: Thornton Heath 1861

THE MERITUS

HIGH CURRENT NEUTRAL LOOP IMPEDANCE AND CONTINUITY TESTER

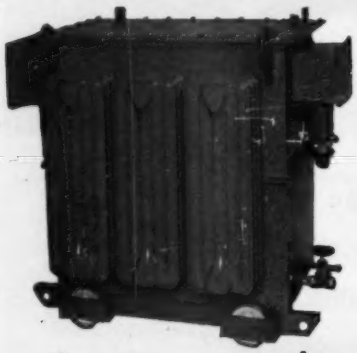
SHOCKPROOF AND SAFE FOR OPERATOR AND INSTRUMENT

This instrument will SAFELY carry out tests on electrical installations and appliances as recommended in the I.E.E. Regulations, 13th Edition, 1955, Section 5.

MERITUS (BARNET) LTD.

BARNET, HERTS. **Bar. 2291/2**

It's a **STURDY** *transformer...*



OVER 25 YEARS' MANUFACTURING EXPERIENCE

...in more ways than one

As supplied to Govt. Depts., National Coal Board, C.E.A. and many other large industrial undertakings.

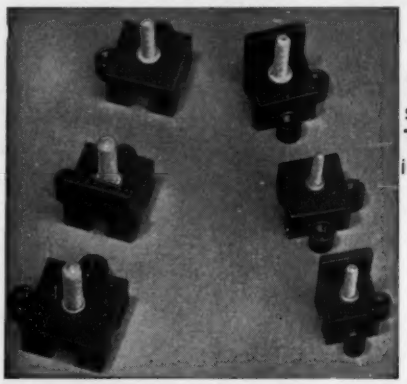
From 500 VA to 100 kVA with special emphasis on the range 5 kVA to 100 kVA.

Sturdy ELECTRIC CO. LTD.

STURDY WORKS, HAMSTERLEY COLLIERY, NEWCASTLE-ON-TYNE

Phone: EBCHESTER 271

No longer ***NEW*** *but accepted.*



Unit construction TER-MATE inter-locking terminal blocks

Patented

Repeating orders and C S A Approval confirm the adaptability of these terminals which are now available in stud sizes ranging from 4. B. A. to 5/16" moulded in bases 5/8" square to 1 1/4" with or without barriers.

Any shape, any number of ways, anywhere, all as an integral unit, ideal for panels etc.

Samples and literature on request:—

TERMINATION EQUIPMENT CO. LTD.

NOEL WORKS, ELSON STREET, BASFORD, NOTTINGHAM

Tel.: Nottm. 70628/9

AEROFLEX
Fluvent

CABINET STYLE DISTRIBUTION BOARDS WITH ISOLATING SWITCHES

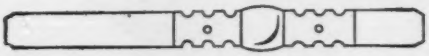
Widespread acceptance of Fluvent Cabinet Style Boards has resulted in production of a Switch of similar exterior. Intended principally for use as control switches mounted in conjunction with the boards, 30 and 60 amp. sizes are available with S.P. and neutral link as an alternative to D.P. (in the same dimensions as D.P.), and T.P. with neutral link (in the same dimensions as T.P.).

UNOBTRUSIVELY EFFICIENT

Both boards and switches have pressed steel cabinets which are cadmium plated and painted to give a grey metallic hammer finish. All edges are rounded to a uniform radius, the lid is sunk flush and the hinges invisible. Maximum accessibility is ensured by the door swing which is almost 180°.

WITH Aeroflex ENERGY LIMITING FUSES

Cabinet Style Distribution Boards are fitted with Aeroflex Energy Limiting High Breaking Capacity Cartridge Fuse Links to British Standard No. 88, 1952, 46 K.A. Breaking Capacity on 440 volts, with 1.25 fusing factor. Standard fully wired cartridge fuse links are included unless otherwise specified, when appropriate underwirings can be fitted. Fuse links are not discarded when blown — they can be returned for prompt replacement under our rewiring service scheme.



✻ *The latest type of Aeroflex fuse element as employed in the AD and FC type Energy Limiting Fuses.*

Parmiter Hope & Sugden Ltd

FLUVENT ELECTRICAL WORKS MANCHESTER 12

London: 34 Victoria Street, S.W.1. *Glasgow:* 5 Somerset Place, C.3 *Birmingham:* 39/41 Carrs Lane, 4

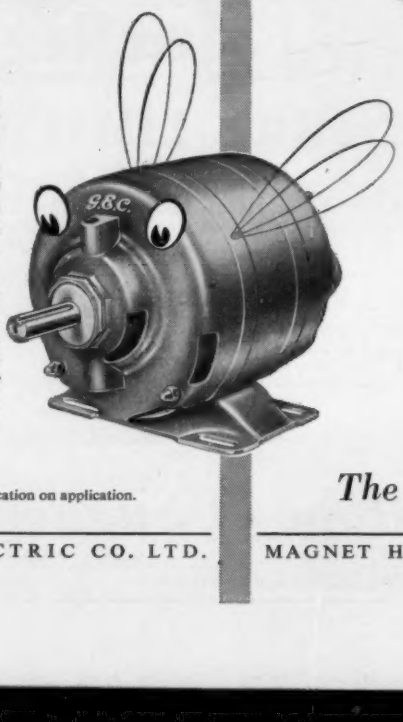
H dm PH137

G.E.C.

Fractionals

put power where you want it

Power for many purposes. Power to drive your own plant efficiently, or to add further distinction to the equipment you make and sell. Power. As much (up to 1 h.p.) or as little as you need, in a wide range of mountings, but always with the reliability for which all G.E.C. engineering is famous. Power, from sturdy, dependable G.E.C. Fractionals. Most sizes and mountings are held in stock—that's another advantage of dealing with the G.E.C.



G.E.C. manufacture many types and sizes of fractional motors for light industrial and domestic drives—whether for your plant or products our engineers will always be pleased to help you choose the right motor for the job.

Fully detailed illustrated publication on application.

The Busy Bee from G.E.C.

THE GENERAL ELECTRIC CO. LTD. MAGNET HOUSE, KINGSWAY, LONDON W.C.2

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue and should be addressed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

CITY OF BELFAST

Electricity Department

STORES

TENDERS are invited for the supply of the undermentioned materials :—

Form No.

1. Turbine Oil.
2. Transformer Oil.
3. Firebricks, Fireclay and Binding Cement for high-temperature furnace requirements.
5. Carbon Brushes.
8. Glazed Stoneware Ducts and Troughing, and Covering Tiles.
9. Feeder, Section and Street Lighting Control Pillars.
10. 6,600-volt Compound Filled Armour-clad Switchgear.
11. Meters, Instrument Transformers and ancillary equipment.
12. Electricity Maximum Demand Indicators.
13. Time Switches.
14. L.T. Fuse Units, Service Cut-outs and Accessories.
15. Distribution Transformers.
17. Thermostats and Switches for Domestic Electric Cookers and Thermostats for Immersion Heaters.
18. Electric Washboilers.
19. Electric Kettles.
21. Electric Cookers.

Forms of tender may be obtained from the Electricity Department, East Bridge Street, Belfast, on payment of the sum of ten shillings (non-returnable) for each form. Extra copies of the forms may be obtained at five shillings each (non-returnable). Cheques should be made payable to the Belfast Corporation Electricity Department.

All letters, catalogues, drawings, etc., accompanying tenders must be submitted in duplicate.

Tenderers are advised that the Corporation Conditions of Contract only will apply. Any other conditions put forward by tenderers will not be accepted.

Tenders, in sealed envelope marked "Tender for Stores, Electricity Committee," and endorsed with the name and address of the firm tendering, must reach the undersigned not later than 4 p.m. on Friday, 24th January, 1958.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

P.O. Box 234,
City Hall, Belfast.
28th December, 1957. 1780

CLASSIFIED ADVERTISEMENTS

ARE PREPAID

CITY OF BELFAST

Electricity Department

TENDERS are invited for the supply and delivery of :—

ALKALINE TYPE SWITCH CLOSING AND TRIPPING BATTERIES WITH CHARGING, CONTROL AND DISTRIBUTION EQUIPMENT FOR 33-kV STEP-DOWN SUBSTATIONS.

Form of tender and specification (No. W.128) may be obtained at the Electricity Department, East Bridge Street, Belfast, on payment of a deposit of two guineas, which amount will be refunded provided a bona fide tender is lodged and not withdrawn. Extra copies of the contract documents may be obtained at one guinea each, which sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each tender, in sealed envelope marked "Tender for Switch Closing and Tripping Batteries, etc., Electricity Committee," and endorsed with the name and address of the tenderer, must reach the undersigned not later than 4 p.m. on Friday, 24th January, 1958.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

P.O. Box 234,
City Hall, Belfast.
1st January, 1958. 1779

BOROUGH OF CHATHAM

Street Lighting Improvements, Trunk Road A.2

TENDERS are invited for (a) the supply of lighting equipment and control gear, and (b) the dismantling of existing equipment, taking down and resiting most of the existing steel columns, the provision and erection of new steel columns and brackets, and the installation of 80 units of horizontal burning mercury vapour lighting equipment rated at 400 watts.

Forms of tender, specification and bill of quantities can be obtained from, and the plan together with the general conditions of contract can be seen at, the office of Mr. J. A. T. Richards, Borough Engineer and Surveyor, Town Hall, Chatham, on payment of a deposit of £2 2s., which will be refunded on receipt of bona fide tenders or the return of all documents.

Tenders must be delivered to the undersigned by midday on Monday, 20th January, 1958.

The Council do not bind themselves to accept the lowest or any tender, and reserve the right to accept both, or either one of tenders (a) and (b).

ROWLAND NEWNES,
Town Clerk.

Town Hall,
Chatham.
17th December, 1957. 1749

CITY OF MANCHESTER

Davyhulme Sewage Works

TENDERS invited for supply and installation of seven Transformers for main power services. Tender documents from the City Surveyor, Town Hall, Manchester, 2, on payment of a deposit of £2 2s., returnable on receipt of a bona fide tender. Tenders to be returned by 20th January, 1958. 1759

FEDERATION OF RHODESIA AND NYASALAND

Federal Power Board

Kariba Hydro Electric Scheme

THE Federal Power Board will shortly be calling for tenders for the supply, delivery, installation and maintenance of 88-kV, 33-kV and 11-kV Cables, Auxiliary Cables and Accessories at Kitwe Substation, situated in Northern Rhodesia, and at Salisbury, Norton, Sherwood and Bulawayo Substations, situated in Southern Rhodesia.

Contractors who may be interested in tendering for this equipment should submit full details of their qualifications and experience by the 23rd January, 1958, after which tender documents and drawings will be issued to those contracting organisations who satisfy the requirements of the Board.

Details, qualifications and experience should be sent in duplicate to the Secretary, Federal Power Board, Box 630, Salisbury, Southern Rhodesia, with a copy to the Mechanical and Electrical Consulting Engineers, Merz and McLellan, Carliol House, Newcastle upon Tyne, 1, England. 1786

COUNTY BOROUGH OF BLACKPOOL

Illuminations and Street Lighting Department

TENDERS are invited for the supply and delivery of the following materials :—

(a) 203 Double Spigot Spun Iron Pipes, 12" i.d. × 9' length.
(b) 22 Double Spigot Spun Iron Pipes, 10" i.d. × 9' length.
(c) 50 25' × 5¼" o.d. base Lightweight Steel Stepped Poles.
(d) 22 36' × 8¾" o.d. base Heavy Duty Steel Stepped Poles.
(e) 208 12" × 12" C.I. Manhole Covers and Frames.

Specifications, forms of tender and general conditions may be obtained from the Illuminations and Public Street Lighting Officer, Illuminations and Street Lighting Department, Rigby Road East, Blackpool.

Tenders must be enclosed in the addressed envelope provided and sealed, and must reach the undersigned not later than 10 a.m. on Thursday, the 16th January, 1958.

ERNEST C. LEE,
Town Clerk.

P.O. Box 11,
Town Hall,
Blackpool. 1758

SITUATIONS VACANT

ELECTRICAL TECHNICIAN

required at the

ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL

to assist an engineer in running two electromagnetic separators and a small workshop.

Apprenticeship or equivalent training in electrical engineering and subsequent experience of electrical or electronic equipment required. Experience with high-vacuum systems and of staff supervision desirable.

Salary £875-£1,050 (Tech. II).

Send POSTCARD to Recruitment Officer (977Y/48), A.E.R.E., Didcot, Berks, for application form and details. 1763

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division :—

THIRD ASSISTANT ENGINEER (Electrical), GENERATION (Construction) DEPT., CASTLE DONINGTON POWER STATION SITE (Vacancy No. 225/57/ER).

Applicants should have had a fundamental training in electrical engineering, including workshops, and should preferably have had experience in the manufacture, erection and maintenance and operation of electrical plant as installed in modern power stations. Preference will be given to candidates who possess a degree or are Graduate Members of the Institution of Electrical Engineers.

Salary will be within Class AX/EX, Grade 6 (£895-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 8th January, 1958.

THIRD ASSISTANT ENGINEER (Civil), GENERATION (Construction) DEPT., SPONDON "H" POWER STATION (Vacancy No. 224/57/ER).

Preference will be given to applicants who hold a degree in Civil Engineering, are Corporate Members of the Institution of Civil Engineers, or possess equivalent qualifications.

Applicants should have had some experience in the design and construction of heavy foundations, river works, structures in reinforced concrete and steel, and other civil engineering works associated with the design and construction of power stations. Experience in assisting in the preparation of specifications, bills of quantities and estimates will be an advantage. The successful applicant will be required to act as Assistant to the Resident Civil Engineer on Site at Spondon "H" Power Station.

Salary will be in accordance with Class AX/EX, Grade 6 (£895-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 8th January, 1958.

SECOND ASSISTANT ENGINEER, GENERATION (Operation) DEPT., DIVISIONAL HEADQUARTERS (Vacancy No. 223/57/ER).

Applicants should have received a sound practical and theoretical training in all aspects of steam plant engineering, experience in operation and efficiency work in large modern power stations, and should have reached at least Higher National Certificate standard.

Salary will be within Class AX/EX, Grade 4 (£1,145-£1,410 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 8th January, 1958.

GENERAL ASSISTANT ENGINEER (Chemist), LINCOLN POWER STATION (Vacancy No. 227/57/ER).

Candidates must have had a sound technical training and some previous experience in an industrial laboratory and should hold the Ordinary National Certificate in Chemistry.

The duties will include the routine analysis of coal, water and oil, but the post offers opportunities of gaining general experience in the chemical control of power station operation.

Salary will be within the range £540-£680 per annum in accordance with the National Joint Board Agreement.

Closing date for receipt of applications, 15th January, 1958.

The appointments will be pensionable within the provisions of the Central Electricity Authority and Area Boards (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.

18th December, 1957. 1781

CENTRAL ELECTRICITY AUTHORITY

London Division

APPLICATIONS invited for following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or B. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

ASSISTANT ENGINEER (Technical), TAYLORS LANE POWER STATION (Vacancy No. 57/1173).

Assisting in general power station technical matters. Salary Class F, Grade 14 = £580 p.a.

ASSISTANT ENGINEER (Instruments), TAYLORS LANE POWER STATION (Vacancy No. 57/1174).

Repair and maintenance of power station instruments. Salary Class F, Grade 12 = £675 p.a.

Applications, quoting vacancy number, to (or on form from) Central Electricity Authority, London Division, P.O. Box 136, London, W.1, by 18th January, 1958. 1809

ENGLISH ELECTRIC

FUSEGEAR DIVISION

who manufacture a wide range of switchboards and distribution equipment incorporating H.R.C. fuses, have a limited number of vacancies for

SALES AND CONTRACTS ENGINEERS

at their Liverpool works. These positions are pensionable after a qualifying period and offer excellent opportunities for promotion and advancement to keen young engineers interested in making a career with the company.

Outside Representatives for both Home and Overseas Branches are appointed from the inside staff from time to time after completion of training, and applicants would be eligible for consideration after an initial period of not less than 3 years.

Qualifications required are H.N.C. or equivalent plus sound practical training and experience in (a) electricity supply or (b) industry.

Applications will also be considered from engineers who are at present in the final year of study for H.N.C.

Write giving full details to—

Dept. C.P.S.

336/7, Strand, London, W.C.2

quoting

Ref. ER.401L.

358

CENTRAL ELECTRICITY AUTHORITY

London Division

APPLICATIONS invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or B. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for posts (a) and Corporate Membership for posts (b) an advantage.

(a) ASSISTANT SHIFT CHARGE ENGINEER, BATTERSEA POWER STATION (Vacancy No. 57/1154).

Responsible to Shift Charge Engineer for electrical operation matters. Salary Class L, Grade 9 = £1,115 plus shift £106 10s. per annum.

(b) SHIFT CHARGE ENGINEER, BATTERSEA POWER STATION (Vacancy No. 57/1155).

Sound engineering training necessary followed by considerable experience in operation and maintenance of modern high-pressure, high-temperature power station plant. Character and ability to supervise staff essential. Salary Class L, Grade 7 = £1,285 plus £123 10s. shift p.a.

(a) STATION CHEMIST, BLACKWALL POINT POWER STATION (Vacancy No. 57/1156).

Industrial experience and holding at least H.N.C. in Chemistry. Experience in technology of fuels and waters essential. Knowledge of P.F. boiler operation preferred. Salary Class F, Grade 7 = £935 p.a.

(b) BOILER HOUSE SUPERINTENDENT, BRUNSWICK WHARF POWER STATION (Vacancy No. 57/1157).

Applicants must possess good engineering background with experience in maintenance and operation of H.P. boiler plant, pulverised fuel firing equipment and fuel handling gear. Duties will also include planning and programming plant maintenance together with efficient operation and control of costs. Salary Class K, Grade 6 = £1,285 p.a.

(Applicants to vacancy 57/436 advertised in May, 1957, will be reconsidered.)

(a) SENIOR DRAUGHTSMAN (Electrical, ENGINEERING DRAUGHTSMAN (Electrical), GENERATION (Construction) DEPT. (Vacancy No. 57/1158).

Practical training and/or experience in engineering drawing office and technical training to O.N.C. or H.N.C. standard, to join teams engaged in power station development, design and layout. Opportunity to gain knowledge and for advancement, including visits to site. Salary Schedule D, Grade 4, 5 and 6 = £635 to £1,045 p.a.

(a) FOURTH ASSISTANT ENGINEER, UTILISATION RESEARCH SECTION, TECHNICAL DEPARTMENT, 95, PARK STREET, SOUTHWARK, LONDON, S.E.1 (Vacancy No. 57/1159).

Testing and maintenance of single and polyphase pen recording, indicating and integrating instruments and instrument transformers in test room, on site, and possibly for short periods out of London at discretion of Authority. Salary Class AX/EX, Grade 8 = £750-£985 p.a.

Applications, quoting vacancy number, to (or on form from) Central Electricity Authority, London Division, P.O. Box 136, London, W.1, by 10th January, 1958. 1764

ELECTRICAL ENGINEER REQUIRED TO ASSIST DIRECTORS

OPPORTUNITY for bright young man with initiative and knowledge of rotating machinery and all types of control gear. Candidates should be able to design circuits for automatic control and contactor gear, and have had drawing office experience. Qualifications preferred are Higher National Certificate or a University Degree.

Good salary and excellent prospects.

Applicants should state technical qualifications, age and experience, present position and salary in strict confidence to Hampson Industries Limited, Bull Lane, Greets Green, West Bromwich. 1803

SOUTH EASTERN ELECTRICITY BOARD

DISTRICT COMMERCIAL ENGINEER, Croydon and Purley District.

Salary £1,375 to £1,465 p.a. (including London Area allowance) under N.J.B. Class H, Grade 3. Superannuable. Croydon and Purley is a major district with 130,000 consumers, 8 showrooms and a large repair workshop covering sub-area requirements. Candidates should have good technical and personal qualifications and must be fully experienced in all aspects of district commercial work.

Applications, naming two referees, to H. Lowe, M.I.E.E., District Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 15th January, 1958.

SENIOR DRAUGHTSMAN, Croydon and Purley District.

Salary £800 to £910 p.a. (including London Area allowance) under N.J.B. Class D, Grade 5. Superannuable. Applicants should be suitably qualified and capable of supervising a large district drawing office under the District Engineer. Experience in basic design, layout of substations up to 11 kV, presentation of data and mains and system records is essential.

Applications, naming two referees, to H. Lowe, M.I.E.E., District Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 15th January, 1958.

SECOND ASSISTANT ENGINEER, Central Sussex District.

Salary £885 × £15 to £930 under N.J.B. Class F, Grade 7. Superannuable. Applicants should be qualified engineers with sound knowledge of all aspects of the work of a district distribution department. Experience should include the planning, construction, operation and maintenance of underground and overhead systems up to 33 kV.

Applications, naming two referees, to Arthur Barnes, M.I.E.E., District Manager, SEEBOARD, Electra House, Church Road, Haywards Heath, Sussex, by 15th January, 1958.

SHOWROOM ASSISTANT (Male), Croydon and Purley District.

Salary from £410 at age 21 to £525 or £605 (including London allowance) according to age, qualifications and experience. Superannuable. Applicants should be experienced in general showroom and cashier duties and be prepared to work in any of the showrooms in the Croydon and Purley District.

Applications, naming two referees, to H. Lowe, M.I.E.E., District Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 15th January, 1958.

LADY DEMONSTRATOR, West Kent District.

Salary £500 × £20 to £600 p.a. plus London weighting under N.J.C. Grade 1. Superannuable. Applicants should possess a recognised diploma or certificate in domestic science, also E.A.W. Certificate. The successful applicant will be required to conduct lectures and demonstrations, advise consumers and generally assist in showrooms.

Applications, naming two referees, to West Kent District Manager, SEEBOARD, 270, High Street, Orpington, Kent, by 15th January, 1958.

A. L. BURNELL,
Secretary. 1812

CENTRAL ELECTRICITY AUTHORITY

North Eastern Division

Fourth Assistant Engineer, Technical Dept. (Telecommunications)

APPLICATIONS are invited for the above appointment with Headquarters at Newcastle upon Tyne.

Applicants should have had experience in the installation and maintenance of automatic telephone equipment. Some knowledge of electronics would be an advantage.

Technical qualifications of Graduate I.E.E. standard are desirable.

The salary for this appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Grade 8, Schedule B (£710-£910 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from any office of the Authority, or from Divisional Establishments Officer, Central Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne, 1, to whom they should be returned to arrive not later than 15th January, 1958. 1810

YORKSHIRE ELECTRICITY BOARD

No. 2 (Huddersfield) Sub-Area
HALIFAX DISTRICT.

THIRD ASSISTANT DISTRICT ENGINEER, Todmorden Unit based at Hebden Bridge. Applicants should be Graduate Members of the Institution of Electrical Engineers or hold equivalent qualifications, and have had experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution networks, substation plant and ancillary equipment.

Salary N.J.B. Class H, Grade 9, £885/£15/£930 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market Street, Huddersfield, not later than 13th January, 1958.

No. 6 (Hull) Sub-Area
BRIDLINGTON DISTRICT (Driffield).

SURVEYOR. Applicants should have had experience in the use of the theodolite and level and in the preparation of plans and sections in connection with land surveys. Experience in the survey of routes for overhead lines and in the preparation of profile drawings and pole schedules will be an advantage but is not essential.

Salary N.J.B. Schedule D, Grade 6, £595/£20/£715 per annum.

CARTOGRAPHIC AND RECORDING DRAUGHTSMAN. Applicants should be neat and accurate draughtsmen with general drawing office experience, and a knowledge of work in connection with ordnance maps will be an advantage.

Salary N.J.C. General Clerical Grade, £200/£565 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 13th January, 1958. 1797

CANADA

TURBINE DESIGN ENGINEER

required by

CANADIAN WESTINGHOUSE COMPANY LIMITED

HAMILTON, ONTARIO

for a challenging senior design position in the engineering department of the Motor and Generator Division.

QUALIFICATIONS:

Graduation from a recognised university.

At least 5-10 years' experience in turbine design.

Conversant with all phases of steam power plant equipment and design.

BENEFITS:

Top industrial salaries.

Relocation assistance.

Excellent welfare plan coverage.

Please submit enquiries, indicating interest, to:

Dept. C.W.C. 3,
Canadian Department of Labour,
61, Green Street, London, W.1.

1761

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:—

Central Gloucestershire Sub-Area

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER (Dean Forest).

Responsibilities will include contracting, and electrical apparatus, radio, T.V. and refrigeration repairs. Applicants should have had experience in estimating for all classes of electrical installation work, the preparation of tenders and specifications. A sound knowledge of installation practice with good commercial ability is necessary. Technical qualifications desirable. Salary £790/£835 per annum (N.J.B. Grade E.8).

FOURTH ASSISTANT ENGINEER, COMMERCIAL DEPARTMENT (Headquarters).

Applicants should have knowledge of sales organisation associated with electrical appliances. The successful applicant will be required to assist in all branches of the department, and particularly in sales of appliances, exhibitions and commercial catering. Technical qualifications desirable. Salary £790/£835 per annum (N.J.B. Grade J.12).

Apply, by letter, within 14 days, stating age, experience, present position and salary, to S. Raybould, Sub-Area Manager, Midlands Electricity Board, 126, London Rd., Gloucester.

North Staffs. Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER (Leek).

Candidates should have had a sound technical training and experience in the construction, maintenance and operation of overhead and underground networks up to and including 33 kV. Technical qualifications desirable. Salary £835/£880 per annum (N.J.B. Grade E.7).

Apply, by letter, within fourteen days, stating age, qualifications, present position and salary, to District Manager, Midlands Electricity Board, Station Street, Leek, Staffs.

South Staffs. and North Worcs. Sub-Area

GENERAL ASSISTANT ENGINEER (Meter Department) (Headquarters).

Duties will include laboratory work, substandard instrument calibration, testing of polyphase metering equipment, both in the test room and on consumers' premises, and the carrying out of special tests on other apparatus, including switchgear and relays. Technical qualifications desirable. Salary £590/£635 per annum (N.J.B. Grade L.18).

Apply, by letter, within fourteen days, stating age, education, qualifications, experience, present position and salary, to Mr. T. G. Keeler, Sub-Area Manager (Ref. CW), Midlands Electricity Board, P.O. Box No. 9, Toll End Road, Tipton.

A. STEPHENS,
Secretary. 1760

CENTRAL ELECTRICITY AUTHORITY

North Eastern Division

Fourth Assistant Engineer Technical Department

APPLICATIONS are invited for the above appointment in the Protective Gear and Electrical Plant Testing Section of the Technical Department with Headquarters at Newcastle upon Tyne.

The duties consist of the testing, commissioning and maintenance of electrical protective gear and the testing and commissioning of alternators, transformers, switchgear, lines, etc., designed for working at voltages up to 275 kV and their ancillaries.

Applicants should possess qualifications approaching Grad. I.E.E. standard and experience with H.V. equipment or protective gear would be an advantage.

The salary for this appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Schedule B, Grade 7 (£810-£1,010 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Divisional Establishments Officer, Central Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne, 1, to arrive not later than 15th January, 1958. 1811

Situations Vacant (continued)

UNIVERSITY OF ADELAIDE
South Australia

THE increased financial support for the University to be provided by the State and Commonwealth Governments following their general approval of the report of the Murray Committee on Australian Universities makes it possible for the University at once to invite applications for the following appointment at the new salary scale stated below :—

LECTURER IN ELECTRICAL ENGINEERING. Preference will be given to a candidate strong in Mathematics and Physics, and with experience in electronics design and laboratory work.

The new salary scale for a Lecturer is £A1,420-£A90 (7) to £A2,050 p.a. Superannuation is provided on the F.S.S.U. basis. The initial salary within the scale will be fixed in relation to the qualifications and experience of the successful candidate.

General terms of appointment may be had from the Registrar of the University or from the Secretary of the Association of Universities of the British Commonwealth, 36, Gordon Square, London, W.C.1. These give particulars of general duties, tenure, study leave, promotion and travelling expenses.

A potential candidate in Great Britain may borrow from the Secretary of the A.U.B.C. a coloured film illustrating the University (including the Waite Institute) and the city and surroundings of Adelaide.

The University Calendar may be consulted in the Library of any University which is a member of the A.U.B.C. Further information about the University or about any particular post will gladly be supplied on request to the Registrar.

Applications must include particulars of age, nationality, marital status, academic record, teaching qualifications, war service (if any) and present position; a list of publications; copies of testimonials; the names and addresses of two referees of whom confidential enquiries may be made; a recent photograph; and a medical certificate of good health. They should be lodged in duplicate with the Registrar of the University, Adelaide, South Australia, not later than 15th February, 1958. 1802

SOUTH EASTERN ELECTRICITY BOARD

THIRD ASSISTANT DISTRICT ENGINEER, Tunbridge Wells District. Salary £790 × £15 to £835 p.a. under N.J.B. Class F, Grade 9.

Candidates should preferably have the Higher National Certificate or equivalent, and practical experience in the operation, maintenance and construction of M.V. and 11-kV underground and overhead systems.

The successful candidate will be required to undertake standby duties and reside in or near Tunbridge Wells.

Applications, naming two referees, to T. W. Dann, M.Eng., M.I.E.E., Tunbridge Wells Manager, SEEBOARD, Town Hall, Tunbridge Wells, by 15th January, 1958.

ASSISTANT DISTRICT COMMERCIAL ENGINEER, Woking District. N.J.B. Class F, Grade 8, £835-£880 per annum. Superannuable.

Applicants should be technically trained and be conversant with the commercial activities of a district. Initially the principal duties will be to organise and control the work in connection with a large voltage standardisation programme.

Applications, naming two referees, on forms from E. Peel, A.M.I.E.E., Woking Manager, SEEBOARD, 4, Chobham Road, Woking, by 15th January, 1958.

A. L. BURNELL,
Secretary. 1778

CENTRAL ELECTRICITY AUTHORITY
Southern Division

ELECTRICAL FITTER with power station or similar experience required at Poole Generating Station. N.J.I.C. conditions of employment. Rate of pay 4s. 7½d. per hour for a 44-hour, 5-day week.

Applications in writing to the Station Superintendent, Poole Generating Station, Rigler Road, Poole, not later than 8th January, 1958. 1774

WALSALL AND STAFFORDSHIRE TECHNICAL COLLEGE
Joint Education Committee

Principal: H. Cheetham, B.Sc.Hons., A.M.I.Mech.E., M.I.Prod.E.

APPLICATIONS are invited from suitably qualified persons for the following full-time teaching appointments :—

LECTURER IN ELECTRICAL ENGINEERING.

Applicants must be graduates in electrical engineering and be able to teach Electrical Engineering subjects, including Electrical Machines, to Higher National Certificate standard.

Duties to commence 1st May, 1958.

LECTURER IN MECHANICAL ENGINEERING.

Applicants must be graduates in mechanical engineering and be able to teach Mechanical Engineering subjects, including Strength of Materials, to Higher National Certificate standard.

Duties to commence as soon as possible.

GRADE A ASSISTANT IN MECHANICAL ENGINEERING.

Applicants must possess a Higher National Certificate in Mechanical Engineering and be able to teach Mechanical Engineering subjects to Ordinary National Certificate standard.

Duties to commence as soon as possible.

Salaries will be in accordance with the Burnham Technical Report, 1956, viz.:—

Lecturer, £1,200 by £30 to £1,350 p.a.

Grade A Assistant, £475 by £25 to £900 p.a. with additions for training and experience.

Application forms and further particulars may be obtained from the Principal, Walsall and Staffordshire Technical College, Wisemore, Walsall, Staffs., to whom completed application forms should be returned not later than Friday, 17th January, 1958.

V. MILLSON,
Secretary to the Joint Committee.

23rd December, 1957. 1799

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area, Hemel Hempstead District

FOURTH ASSISTANT ENGINEER (161/57.R).

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground systems, including substations.

Salary N.J.B. Class F, Grade 11 (£685-£730).

Apply by letter, within 14 days, to the Manager, Hemel Hempstead District, Eastern Electricity Board, Bridge Street, Hemel Hempstead, Herts.

Northmet Sub-Area, Barnet District

THIRD ASSISTANT ENGINEER (Ref. 771) (162/57/.R).

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems including substations.

Salary N.J.B. Class F, Grade 9 (£790-£835) plus London allowance.

Apply by letter to L. F. G. Baker, Manager, Eastern Electricity Board, 7c, High Street, Barnet, by 13th January, 1958.

Fens Sub-Area

FOURTH ASSISTANT ENGINEER (Protection) (163/57.R).

Applications are invited for the position of Fourth Assistant Engineer to operate with the Protection Department based at Bourn, near Cambridge.

Candidates should have good technical qualifications and preferably some experience in system operation, including fault currents, relay settings, commissioning and routine tests on protective gear associated with systems up to 33 kV.

Salary N.J.B. Class J, Grade 13 (£740-£785).

Apply by letter, within 14 days, to the Secretarial Officer, Fens Sub-Area, Eastern Electricity Board, Milton Hall, Milton, Cambridge. 1798

SOUTHERN ELECTRICITY BOARD

Advertising Officer

Chief Commercial Officer's Department at the Head Office of the Board, Maidenhead. Commencing salary in accordance with N.J.C. 7 (£1,035-£1,125 per annum). N.J.C. conditions of service.

Applicants should be experienced in the handling of all forms of advertising (excluding display work) and be able to control the planning and production of advertising campaigns in all media and to work in collaboration with the Board's advertising agents.

Applications on forms obtainable from the Secretary, Southern Electricity House, Littlewick Green, Maidenhead, and returned to him, in envelopes suitably endorsed, not later than 13th January, 1958.

Assistant Engineer (Maintenance and Operation)

Aldershot District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class G, Grade 12 (£685 × £15 to £730 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution, mains and substations, and with minor construction work. The possession of suitable technical qualifications will be an advantage. The appointment will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed not later than 13th January, 1958.

The successful candidates for the above appointments will be required to contribute to the Central Electricity Authority and Area Boards (Staff) Superannuation Scheme, if eligible. 1788

H.N.C. (E.) OR O.N.C. (E.)

TENDERING AND CONTRACTS ENGINEERING

with

'ENGLISH ELECTRIC' STAFFORD

WE wish to appoint a number of young Engineers in the following fields :—

MINING.
METAL INDUSTRIES.
INDUSTRIAL PLANT.
POWER TRANSFORMERS.
POWER SYSTEMS METERS AND RELAYS.

There are openings for engineers with either the qualifications to continue or the wish to take up a career in this work.

A COURSE will be arranged for suitable people who have insufficient experience for direct employment.

These are all pensionable staff appointments.

Please write, indicating the field in which you have most interest, to Dept. C.P.S., Marconi House, 336/7, Strand, London, W.C.2, quoting Ref. ER.1297J.

1765

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT CONSUMERS' ENGINEER required in the Warrington District. Salary within range £740/£785 per annum (N.J.B. G/11).

The duties of the post will include estimating for contracting work, advising consumers on matters relating to electricity supply and the utilisation of electrical equipment.

Applicants should have received an engineering training, and be in possession of an Ordinary National Certificate in Electrical Engineering or equivalent qualification.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway House, near Northwich, Cheshire. Closing date, 15th January, 1958. 1800

SOUTH OF SCOTLAND ELECTRICITY BOARD

Edinburgh and Borders Area

Engineering Vacancies

APPLICATIONS are invited for the undernoted vacancies in Edinburgh.

(a) SECOND ASSISTANT DISTRICT ENGINEER (Edinburgh West District). Salary N.J.B. Schedule A, Class F, Grade 7 (£885-£930).

(b) THIRD ASSISTANT DISTRICT ENGINEER (Edinburgh East District). Salary N.J.B. Schedule A, Class F, Grade 9 (£790-£835).

Conditions of service will be in accordance with the National Joint Board Agreement for the electricity supply industry and the successful candidates will, subject to satisfactory evidence of health, require to become contributors to the Board's superannuation scheme.

Applicants for both positions should have a sound training and subsequent experience with H.V. and L.V. underground distribution systems, including the operation and maintenance of H.V. and L.V. switchgear and cables and a knowledge of protective gear and fault location. The possession of a National Certificate in Electrical Engineering is desirable.

In each case, the successful candidate will require to reside within a reasonable distance of district headquarters.

Applications on the standard form, obtainable from the undersigned or any other Area Manager, should be submitted not later than 20th January, 1958.

C. H. A. COLLYNS,
52, Melville Street, Manager.
Edinburgh, 3.
27th December, 1957. 1816

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable appointment:—

PRINCIPAL ASSISTANT, Chief Commercial Officer's Department, Board Headquarters, Glasgow.

Candidates should possess good general experience of all branches of advertising, copy writing and production of sales literature and brochures. The ability to write precise descriptive matter and articles dealing with the utilisation of electricity are essential qualifications. Knowledge of the electricity supply industry would be an advantage.

This post, which is presently located at 206, St. Vincent Street, Glasgow, C.2, will be transferred to the Board's new Headquarters in Cathcart in approximately twelve months.

Salary £1,145/£1,265 per annum in accordance with Grade 8 of the National Joint Council (Administrative and Clerical Grades) Salary Scales.

Apply quoting Reference No. C10/57, on standard form AE6, available from the Secretary, P.O. Box 173, 351, Sauchiehall Street, Glasgow, C.2, not later than Friday, 24th January, 1958.

Note:—This post was previously advertised on 26th August, 1957. Applications received at that time have been retained for further consideration. 1814

LONDON ELECTRICITY BOARD

Engineering Draughtsman

APPLICATIONS are invited for the above position in the Southern District. Candidates should have a good general and technical education up to Ordinary National Certificate standard, be neat and capable draughtsmen, and be experienced in one or more of the following subjects: drawing office routine, electrical diagrams, layout of plant in transformer chambers, mains survey and recording of mains work.

The post is graded under Schedule D of the National Joint Board Agreement as Grade 6, £635 to £755 per annum, inclusive of London allowance.

Applications on forms obtainable by writing to Personnel Officer, 46, New Broad Street, London, E.C.2, should be returned completed by 13th January, 1958. Please quote ref. PER/2389/R. 1820

CENTRAL ELECTRICITY AUTHORITY

Midlands Division

APPLICATIONS are invited for the following positions in the Testing Section of the Department of the Chief Generation Engineer (Operation). N.J.B. service conditions, superannuable appointments, salaries within Schedule B of the Agreement.

(a) Two FOURTH ASSISTANT ENGINEERS, Grade 8, commencing salary in the range £710-£835, ultimately rising to £935 p.a. (Vacancy No. 708MD).

(b) One GENERAL ASSISTANT ENGINEER, Grade 9, commencing salary in the range £550-£625, ultimately rising to £705 p.a. (Vacancy No. 709MD).

Applicants should possess for :—

(a) A knowledge of electronics and familiarity with non-destructive testing techniques. Appropriate technical qualifications will be an advantage.

(b) Some knowledge of electronics and an interest in non-destructive testing techniques.

Apply, quoting vacancy number, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, by 14th January, 1958. 1775

EAST MIDLANDS ELECTRICITY BOARD

Third Assistant District Engineer, Lincoln District

APPLICATIONS are invited from suitably qualified and experienced engineers for the appointment of THIRD ASSISTANT DISTRICT ENGINEER in the Lincoln District of the Lincolnshire Sub-Area.

The duties will consist of assisting in the operation, maintenance, planning and construction of underground and overhead networks up to and including 11 kV. The possession of suitable technical qualifications will be an advantage.

Ability to drive a motor vehicle is essential and candidates must be in possession of a current driving licence.

The successful candidate will be required to undertake standby duties in due course.

The salary and conditions of the appointment will be in accordance with the National Joint Board Agreement, Class F, Grade 9 (£790-£835 per annum).

Applications stating age, qualifications, education, experience and details of present position should be forwarded to the Manager, Lincoln District, East Midlands Electricity Board, Brayford Side North, Lincoln, to reach him within fourteen days of the issue of this advertisement. 1801

INSTRUMENT ENGINEERS

required by large oil company for work in Middle East. Applicants should have served a full apprenticeship and possess H.N.C.

The man selected will be required to calibrate and repair all types of electrical instruments governing the generation of electricity and the protection of circuits, both single and three-phase, including protective relays of all types, kilowatt indicators, kilowatt hour meters, kilovar indicators, power factor indicators, voltage regulators and frequency meters. In addition he would be responsible for the calibration and repair of test equipment such as A.V.O.s, Meggers, Selectest, etc.

Service will be on three-year contracts with pensionable pay not less than £1,050 per annum plus large local allowance. Paid home leave with free passages every two years. Fully furnished air-conditioned quarters at nominal rental. Bachelor preferred owing to shortage of married accommodation. Age limit 35.

Write giving full details, quoting No. 751, to Box No. 1362, c/o Charles Barker & Sons Ltd., Gateway House, London, E.C.4. 1766

CLASSIFIED ADVERTISEMENTS ARE PREPAID

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable appointment:—

STATION SUPERINTENDENT
KINCARDINE GENERATING STATION

The station, at present under construction, is situated on the Firth of Forth in Central Scotland, and will consist of 3 120-MW units followed by 2 200-MW units giving an ultimate capacity of 760 MW. The units will be coal fired with reheat, having steam conditions of 1,500 P.S.I. 1,000° F. for the 120-MW units and 2,350 P.S.I. 1,050° F. for the 200-MW units.

Candidates should be Chartered Electrical Engineers or have equivalent qualifications, and should have a wide experience in the administration and operation of a modern power station. Arrangements are being made to provide housing accommodation for the successful candidate.

Salary will be in accordance with N.J.M. Class C, Grade 5, £1,900/£2,100 per annum.

Apply, quoting Reference No. E55/57 on standard form A.E.6 available from the Secretary, P.O. Box 173, 351, Sauchiehall Street, Glasgow, C.2, not later than Friday, 17th January, 1958. 1813

MONSANTO CHEMICALS LIMITED

require a

SENIOR ELECTRICAL DRAUGHTSMAN

with experience of power, lighting and control installations in the chemical manufacturing or similar industries. Applicants, preferably with H.N.C. and practical background in electrical engineering, should be able to work on own initiative and in co-operation with design engineers.

The post is permanent and a good salary will be paid commensurate with qualifications and/or experience. Five-day week, staff restaurant and non-contributory pension scheme are in operation.

Applications in writing, giving full details of age, training, qualifications and experience, should be sent to the Chief Personnel Officer, Monsanto Chemicals Ltd., 10-18, Victoria St., London, S.W.1. 1767

ASSISTANT CHIEF ENGINEER

ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL

AN ASSISTANT CHIEF ENGINEER is required to take charge of the main Drawing and Design Office and be responsible for engineers and draughtsmen engaged on a wide variety of engineering and scientific projects.

Applications are invited from professionally qualified engineers with project and design office management experience in the mechanical, electrical or chemical fields. They should preferably have had practical experience of handling toxic or radio-active materials and/or high-voltage/high-frequency work involving vacuum circuits.

The salary will be in the range £2,100-£2,600 p.a.

Write to the Group Recruitment Officer (1001Y/48), A.E.R.E., Didcot, Berks, for further details and an application form. 1776

LONDON ELECTRICITY BOARD

Deputy Secretary

THE London Electricity Board invite applications for the appointment of DEPUTY SECRETARY.

Candidates should have wide experience of secretarial and administrative work with public authorities, preferably in the electricity supply industry.

The appointment will be made on Grade 9, Class C, of the National Joint Managerial Agreement, the salary being within the range £2,760-£2,960 p.a., inclusive of the London Area allowance.

Applications, stating age, qualifications, experience and present position and salary, should be forwarded to the Secretary, London Electricity Board, 46, New Broad Street, London, E.C.2, by 16th January, 1958. (Ref. V/2419/R). 1783

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

Research Laboratories, Leatherhead, Surrey

GENERAL ASSISTANT ENGINEER required to undertake investigations into a variety of mechanical and electrical engineering problems associated with transmission and distribution of electricity, including the static, dynamic and thermal properties of overhead line conductors and fittings. The work will be mainly in the laboratories, but occasionally opportunities for investigations on site will arise.

Candidates should have H.N.C. in Mechanical or Electrical Engineering, and preferably some practical experience.

Salary £550-£725 per annum according to ability.

Applications stating age, qualifications, experience, present position and salary should be forwarded to S. S. Scott, Chief Personnel Officer, 24-30, Holborn, London, E.C.1, by 18th January. Quote ref. E.R./5. 1789

YORKSHIRE ELECTRICITY BOARD

NO. 5 (WAKEFIELD) SUB-AREA, DONCASTER DISTRICT, DEMONSTRATOR (Female).

Applicants must have had experience in the demonstration of electrical appliances and be capable of advising consumers on any matter relating to the use of electricity in the home. They must have had experience in cooking practice and in general showroom duties. Preference will be given to applicants holding the certificate of a recognised Domestic Training College, the Housecraft Advisers' Diploma, the Certificate of the Electrical Association for Women, or an equivalent qualification.

Salary N.J.C. Grade 1, £500/£20/£600 per annum.

Applications giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to The Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a, Denby Dale Road, Wakefield, not later than 17th January, 1958. 1815

RANCO LIMITED

Tannochside, Uddingston, Glasgow, Scotland

SENIOR ENGINEERS FOR RESEARCH AND DEVELOPMENT

ENGINEERS, preferably with Engineering Degree or minimum qualification H.N.C., are required to form the nucleus of a new Research and Development Centre where the accent will be on imaginative thinking and initiative.

The work will be associated with small rotating machines, relays and refrigeration controls, and the laboratories will be located near North Berwick on the East Lothian coast.

Salaries are dependent on qualifications and experience. There is a contributory pension scheme and assistance will be given towards housing and removal expenses.

Enquiries should be addressed in the first instance to Chief Engineer, giving brief details of experience, qualifications, age, etc. 222

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the position of FOURTH ASSISTANT ENGINEER in the Western Sub-Area of the Board at Tenby.

Salary Class G, Grade 12 (£685/£730) of the N.J.B. Agreement.

Applications stating age, present position and salary, qualifications, experience, and three referees, should be addressed to the Secretary (Establishments Section), St. Mellons, Cardiff, so as to reach him not later than Monday, 13th January, 1958. 1762

BRITISH KLOCKNER SWITCHGEAR LIMITED

Chertsey, Surrey

TECHNICAL SALES ENGINEERS required for London and Home Counties. Knowledge of motor control gear; sales experience preferred but not essential. Apply giving full particulars to—Managing Director. 166

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Aberdeen Area

ENGINEERING DRAUGHTSMAN required in the Distribution Department. N.J.B. service conditions, superannuable appointment, salary within Schedule D, Grade 6, £595-£715 per annum.

Applicants should have had a good general and technical education, and experience in the preparation of layout plans, electrical diagrams, and engineering drawings, preferably associated with high voltage substations and for overhead transmission lines.

Application forms, obtainable from the undersigned, to be returned not later than Monday, 13th January, 1958.

J. E. WHITTAKER,
Area Manager.

Area Offices,
Millburn Street,
Aberdeen. 1819

INDEPENDENT TELEVISION

North-East Station

A CHIEF ENGINEER is required immediately by the Programme Contractors for the forthcoming North-East Independent Television Station. This will be the senior technical appointment, and applicants, who must have had considerable previous experience in a senior grade in the television industry, will be required to take charge of and organise the technical equipment, studios and outside broadcast unit of the company.

An attractive salary will be paid to the candidate having suitable qualifications, and pension arrangements will be made.

The successful candidate will be required to live in Newcastle upon Tyne.

Applications in confidence with full particulars of career should be made to P. R. Boys-Stones, District Bank Chambers, Mosley Street, Newcastle upon Tyne, 1. 1827

SOUTH WALES ELECTRICITY BOARD

Appointment of Deputy Chief Engineer

APPLICATIONS are invited for the position of DEPUTY CHIEF ENGINEER at the Board's Head Office, St. Mellons, Cardiff.

The successful applicant will be required to deputise for the Chief Engineer in all matters.

Applicants should preferably be chartered electrical engineers.

The conditions of service are as laid down by the National Joint Managerial and Higher Executive Grades Committee, and the salary will be within the range of £2,300 to £2,600 per annum.

Applications giving full details should be addressed to the Secretary at the Board's Headquarters, St. Mellons, Cardiff, so as to arrive on or before Monday, 20th January, 1958.

Envelopes should be clearly marked "Deputy Chief Engineer." 1756

COUNTY OF LANARK

TECHNICAL ASSISTANT wanted for Council's Lighting Department at Hamilton. Salary A. and P. Grades II and III (£625/£715) with placing according to qualifications and experience. Must have sound technical training and practical experience in electrical engineering; neat draughtsman, capable of preparing all types of working drawings and plans required in connection with work of department. Knowledge of street lighting desirable. Superannuation. Medical examination. No canvassing.

Form of application from County Clerk, P.O. Box 1, Glasgow, and must be returned to him by 6th January, 1958. 1808

SURREY COUNTY COUNCIL

APPLICATIONS invited for the appointment of PRINCIPAL ASSISTANT ELECTRICAL ENGINEER GRADE "A," £1,105 × £45/£35 to £1,320 per annum. A.M.I.E.E. with experience in (a) supervision of technical staff, (b) design and installation of electrical services.

Full details, present salary and three copy testimonials to County Architect, County Hall, Kingston-on-Thames, as soon as possible. 326

WHIPP & BOURNE LTD.

Castleton, Rochdale

THE above company has a vacancy for a SENIOR ENGINEER with experience in A.C. and D.C. switchgear. He will be responsible to the Engineering Director for the organisation of the company's drawing office and should be interested in the development of equipment with which will be closely connected. This is a senior post and applicants must have had very considerable experience. A commensurate salary and pension is available. Apply to the Managing Director stating previous experience on low-tension A.C. and D.C. air circuit breakers.

A number of positions are also available for ESTIMATING ENGINEERS and SENIOR and JUNIOR DRAUGHTSMEN who have had previous experience on A.C. and D.C. air break switchgear. Posts are pensionable. Please apply to the Engineering Director stating present salary. 1790

FREDERICK S. SNOW & PARTNERS

ASSISTANT ELECTRICAL ENGINEERS, senior and intermediate grade, required for the design specification and detailing of various electrification projects.

The scope of work includes power distribution, electrical installations comprising heating, lighting and power in buildings of industrial, commercial and technical usage.

Applicants should preferably be to the H.N.C. standard of technical education, with an apprenticeship or equivalent training, and applicable experience.

Salary in accordance with ability. Luncheon vouchers.

Write giving full particulars of education, training and experience to :—

Monro Building, Wellington Street, London, W.C.2. 1782

CENTRAL ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the post of SHIFT CHARGE ENGINEER, OXFORD GENERATING STATION (S/13.977).

Applicants should preferably be in possession of technical qualifications leading to corporate membership of a recognised professional institution. They should have had previous experience in an electricity generating station and preferably have had manufacturing works experience.

Salary Grade 7, Class D, £790-£835 plus 10% shift allowance.

Special application forms, obtainable only from P. D. A. Oliver, Divisional Secretary, 111, High Street, Portsmouth, should be returned by 15th January, 1958. 1773

DESIGNER OF INDUSTRIAL LIGHTING EQUIPMENT

Applications for the above appointment are invited by

THE BENJAMIN ELECTRIC LIMITED.

Knowledge of fabricating techniques, finishes, lamps and control gear desirable, but initiative and ideas equally important.

The vacancy carries excellent prospects, with appropriate salary according to age, experience and qualifications. Staff luncheon room and pension scheme.

Apply Chief Technical Engineer, Brantwood Works, Tottenham, London, N.17. 177

KENT EDUCATION COMMITTEE

North-West Kent College of Technology

Electrical Engineering Department

LECTURER in Light Current Electrical Engineering required to teach H.N.C. and Radio and Television Servicing subjects. The person appointed will be responsible for a well-equipped radio and measurements laboratory and the equipment of a new laboratory for radio and television servicing. Salary will be in accordance with the Burnham Technical Report, 1956, on the £1,200-£1,350 scale.

Forms of application, together with further particulars, may be obtained from the Principal at the College, Miskin Road, Dartford, Kent. 1787

EASTERN ELECTRICITY BOARD

Sub-Area Manager, Northmet Sub-Area

APPLICATIONS are invited to fill the vacancy arising from the appointment of Mr. C. C. Hill as Chief Engineer to the Board.

The appointment is superannuable and the salary will be in accordance with N.J.M. Class E, Grade 10 (£3,350-£3,575), plus London weighting.

Applications to reach the Secretary, Eastern Electricity Board, P.O. Box 40, Wherstead, Ipswich, Suffolk, by 17th January, 1958. 1817

ARMATURE winder for all types A.C. and D.C. repair work. Good rate, bonus, five-day week, overtime, etc.—Lewis Electric Motors Ltd., Moor Works, Blackamoor Lane, Maidenhead, Berks. 142

CANADA. The Toronto office of a large U.K. electrical engineering company has a vacancy for a commercial engineer for estimating and contracts work. Candidates must have considerable experience of estimating in connection with rotating machines and to a lesser extent transformers and switchgear. The appointment carries a starting salary of $6,000 per annum and the company will be responsible for the cost of passages to Canada for the successful candidate and his family and also for the shipment of his personal and household effects. The initial contract will be for a period of at least three years and there is an excellent contributory pension scheme in operation. Applications will be dealt with in the strictest confidence and candidates are asked to write, giving a summary of qualifications and experience, to—Box 1785.

CIRCUIT design draughtsmen required by company manufacturing industrial control equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middx. 273

CONSULTING engineers require junior electrical draughtsman/engineer for lighting and power installations in offices, colleges, hospitals, etc. Five-day week, bonus. Apply Harding, McDermott & Partners, 17, Doughty Street, London, W.C.1. 331

CONTRACTS engineer required for switchgear company in South Africa. Must be experienced in handling switchgear contracts up to 33 kV, including the checking of connection diagrams and the ordering of protective gear and other associated equipment. Education up to Higher National Certificate level would be an advantage. Minimum period of engagement three years. Passage paid. Salary £100/£120 per month. Applicants should apply, stating age and experience, to—Box 1743.

CONTRACTS engineer with engineering and commercial experience in electrical and/or hydraulic engineering. Degree or H.N.C. an advantage. Good salary and prospects to right man. Pension scheme. Full details training and experience to Contracts Manager, The Harland Engineering Co. Ltd., Canal Road, Timperley, Cheshire. 1822

CROMPTON PARKINSON Ltd., Chelmsford, Essex, invite applications for the position of indoor sales engineer. Applicants would be required to handle enquiries for rotating electrical plant and control gear up to 1,500 h.p./kW, and must have had a sound engineering training and preferably experience in preparing tenders for plant required in power stations, factories and similar installations. Five-day week; contributory superannuation scheme. Please write giving age and details of education and experience to — Personnel Officer. 1731

DEWHURST & PARTNER Ltd. require technical estimator for preparing tenders in their estimating engineering department. Applicant must have good electrical engineering background and have basic knowledge of motor control equipment and its applications. The position is a senior one, and housing assistance will be given to successful applicant if necessary. Canteen facilities, pension scheme. Write giving age, experience, etc., to — Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middlesex. 274

DRAUGHTSMAN required for London electrical contractors' drawing office. Please write stating age, experience, salary required to—Box 1777.

ELECTRICAL engineers, juniors 20-24, required to assist in the preparation of control schemes and specifications of electrical equipment for mechanised electric and gas-fired furnaces and for induction melting furnaces. Also to prepare schedules of electrical equipment and wiring diagrams for tracing. Apply in writing to—The Personnel Manager, Tyburn Road, Erdington, Birmingham. 1791

ELECTRICAL superintendent required to take charge of electrical maintenance and installation work at an opencast mining establishment in British West Africa. Possession of A.M.I.E.E. or H.N.C. qualifications an advantage. The equipment includes normal plant and workshop electrical equipment, power stations, 3,300-volt and L.T. distribution systems. Commencing salary £2,000 plus 5% bonus plus, for married man, passage or separation allowance of £10 per month and £5 per month for each child. 15-month tours followed by 13 weeks' leave on full salary in U.K. Return passage paid. Free furnished quarters and medical attention. Contributory pension scheme with retirement at age 55. Life assurance and dependants' income schemes. Write giving full details experience, stating age, married or single, to — Sierra Leone Development Co. Ltd., Dept. ES6, City-Gate House, Finsbury Square, London, E.C.2. 1784

ELECTRO-mechanical draughtsmen required for production drawing office of company engaged in the manufacture of control gear equipment. Good salaries paid to "first-class" men. Canteen facilities, pension scheme. Housing assistance considered in approved cases. Write giving age, experience, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Works, Inverness Road, Hounslow, Middx. 275

ELECTRONICS engineer required to design and maintain electronic plant in an electrical instrument laboratory. The position requires first-class experience and practice in electronic engineering. The company has a modern contributory pension scheme. 5-day week. Canteen facilities. Please send full details of age, experience and salary desired to—Box 1823.

EXPERIENCED draughtsmen required for interesting design work on process plant and machinery. A good technical background and knowledge of machine design is essential and applicants should be qualified to H.N.C. standard. Salaries are assessed in accordance with age, qualifications and experience and will be reviewed annually. Contributory superannuation and widows' pension fund are in operation and there are excellent canteen, welfare and recreational facilities. Applicants should apply in writing to the Chief Engineer, Pilkington Brothers Limited, Cowley Hill Works, St. Helens, enclosing a brief history of their career and details of their education and qualifications. 1736

EXPERIENCED electrician required to take charge of running and maintenance of back pressure turbine power station and ancillary motors, etc., in paper mill. House available. Apply—Witchampton Paper Mills Ltd., Witchampton, Wimborne, Dorset. 1768

JOINTER (extra high tension) required by London Electricity Board in Central District (City area). N.J.I.C. conditions and wages (4s. 11½d. per hour—44-hr. 5-day week). Write for application forms to Personnel Officer, 46, New Broad Street, London, E.C.2, quoting ref. PER/6264/R. 1804

LABORATORY assistant required to assist in testing and operation of research equipment involving machines and electronics. Applicants should have H.N.C. in Electrical Engineering, or equivalent, and industrial test experience including electronics. Salary up to £750 p.a. according to qualifications and experience. Apply in writing to Electrical Engineering Dept., Imperial College, London, S.W.7, before 14th January. 1792

LONDON consulting engineers require electrical engineers for installation design for hospitals, commercial buildings, schools, etc. Write stating age, qualifications, experience and salary required to—Box 160.

METER repairers (mechanician) required by London Electricity Board in Chief Engineer's Meter and Test Branch at Bermondsey. N.J.I.C. wages and conditions, 4s. 11½d. per hour (44-hour, 5-day week). Write for application forms to Personnel Officer, 46, New Broad Street, London, E.C.2, quoting ref. PER/6235/R. 1821

PLANT superintendent with suitable electrical qualifications required for furniture factory. Good conditions and salary. Apply—Works Manager, Dancer & Hearne Bros. Ltd., Penn Street, Nr. Amersham (Tel. Holmer Green 3154). 1673

PRODUCTION engineer wanted for small electrical control gear works, Taunton, Somerset. State experience and salary required. —Box 353.

PROGRESSIVE electrical cable manufacturers in the North-East of England have a vacancy for an electrical assistant in the research and development department. The work is of an interesting and varied nature and applicants should have a scientific and/or electrical background. Please write stating your age, qualifications and experience to Research Manager.—Box 1793.

PROMINENT British company with technical sales departments throughout West Africa requires an electrical equipment salesman. Candidate must be aged 23-28 and have good educational background, also technical and commercial experience in the field of domestic electrical appliances, including radios, refrigerators, fans, light fittings, cable and wiring accessories. Excellent prospects for right man. Successful applicant will be required to spend approx. 3-4 months with U.K. manufacturers before proceeding to Africa. First class air/sea travel, free furnished quarters and leave on full pay after tours of 18/20 months. Pension scheme. Commencing salary according to age and experience. Applicants should give details of education, domestic status, National Service and commercial experience. Reply, quoting reference EES, to—Box 1805.

SALESMAN required to take charge of electrical department. Must have a thorough knowledge of electrical accessories and domestic appliances, Reading district.—Box 9222.

SENIOR sales representative required for London area, aged 35/45, by reputable industrial lighting fittings manufacturers with expanding business. Position offers good prospects. Contributory pension scheme. Salary £1,000 or more per annum according to experience, with agreed commission on sales. Write stating age, experience, etc., which will be treated in strict confidence, to—Box 1806.

SOUTH Wales electrical contracting company require the services of a progressive branch manager. This is a post of considerable responsibility and remuneration will be agreed accordingly. Applicants must at present be engaged in the management of an electrical contracting office or be completely familiar with such duties; and preferably to normally be resident in South Wales. Your applications will be dealt with in the strictest confidence. Please reply in the first instance to Box 1794, giving full chronological details of your experience.

SWITCHGEAR sales engineer required to handle enquiries and orders for power and substation switchgear. Applicants should preferably have attained H.N.C. standard and have had previous switchgear experience. Write—Personnel Officer, Ferguson Pailin Ltd., Higher Openshaw, Manchester, 11. 1824

TESTER of automatic electric control equipment required. Interesting work with good prospects. O.N.C. standard preferred. Five-day week, pension scheme, canteen facilities. Please write giving full details of age, previous experience, qualifications, etc., to—Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 277

TRANSFORMER draughtsmen, senior and junior, for all types up to 500 kVA. Good salary and housing assistance if needed for the right men.—Transformers & Rectifiers Ltd., Millmead, Guildford. 1694

TRANSFORMER engineer required to control design and drawing office handling transformers of all types up to 250 kVA. Applicant must be fully experienced in the design of transformers in this range and a knowledge of costing would be an advantage. Salary £900 per annum. Apply — Willesden Transformer Company Limited, Manor Park Works, Manor Park Road, Harlesden, London, N.W.10. 311

YOUNG engineer, works experience preferable, required to train as commercial estimator motors and generators. North Kent district. Commencing salary £10/£12. Reply full details—Box 344.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

SALES engineer, age 41, A.M.I.E.E. Home and overseas experience. Open to offers, London preferred.—Box 9224.

SALES BY AUCTION

26th Sale **E. R.**

By Order of the Minister of Supply

CENTRAL ORDNANCE DEPOT, BICESTER, OXON.

Important Sale by Auction by

MIDLAND MARTS LIMITED

of

GOVERNMENT SURPLUS WIRELESS & TECHNICAL SPARES, MACHINE TOOLS, BENCH EQUIPMENT, TOOL KITS, VEHICLE SPARES AND 194 VEHICLES AND TRAILERS

including

Buzzers, Headsets, Morse Keys, Connectors, Cable, Wireless Sets No. 18, Tele Repeaters, Aerials, Telephones, Microphones, Electric Motors, Power Supply Units, Resistors, Condensers, Binoculars, Alternators, Submarine Cable, etc.,

Large Lathes, Furnaces, Drilling Machines, Valve Seat Grinders, Electric Drills, Forges, Compressers, Valve Grinders, Welding Kits, Hacksaw Machines, Bending Machines, Connecting Rod Alignment Machines, Cylinder Boring Machines, Cramping Machines, Piston Grinding and Turning Machines, Distribution Boards, etc.,

which will be sold in large and small lots to suit all buyers on

MONDAY, TUESDAY & WEDNESDAY, 13th, 14th & 15th JANUARY, 1958, at 11 a.m. on each day.

View Days: Wednesday, Thursday & Friday, 8th, 9th & 10th January.

Catalogues, price 6d., to admit two to view and one on sale days, from the Auctioneers, Dept. W.2, Market Square, Bicester, Oxon. (Tel. 73). 1771

ARTICLES FOR SALE

NORTH WESTERN GAS BOARD

East Lancashire Group

FOR SALE:

D.C. Shunt Motors (totally enclosed).

Two	4 h.p.,	960 r.p.m.,	440 v.
One	6 h.p.,	960 r.p.m.,	440 v.
Two	8 h.p.,	1450 r.p.m.,	440 v.
One	11 h.p.,	1450 r.p.m.,	440 v.

All L.D.C. New and Unused.

D.C. Starters for above.

Two	7½ h.p.
One	11 h.p.
One	4 h.p.

One Floor Mounting T.P. & N. Industrial A.C. Board with I/C isolater and one 150-amp. T.P. and one 60-amp. T.P. & N. outgoing fused switches.

Inquiries should be addressed to North Western Gas Board, East Lancashire Group, P.O. Box 27, Blackburn. 1769

REDUCE YOUR MAXIMUM DEMAND

NEARLY new WATFORD Load Control equipment at only 30% of new price. If you have adequate compressed air storage, arc furnaces, heat treatment furnaces, direct electrical heating and can shut off the equipment for a few minutes in any half-hour then this equipment will repay itself in a few months.

Contact—Box 1739.

ELECTROSTATIC PRECIPITATORS

High-tension Mechanical Disc Rectifiers for Sale

SIX secondhand 100-kV Mechanical Disc Rectifiers, LODGE-COTTRELL, type MAC, for disposal. Three of these units are 12½ kVA and three are 25 kVA rating. Each unit consists of one single-phase H.T. transformer, one H.T. disc rectifier incorporating earth connection and milliammeter, and one control panel

Box 20800,
Kenny's Advertising Agency, Dublin, Ireland. 1770

ELECTRIC HOUSE SERVICE METERS

PREPAYMENT and credit, 200/250 v. A.C., 1/p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.

ALBERICE METER COMPANY
Fairfax Works, Fairfax Rd., London, N.8
(Tel. MOUntview 7944, 0373) 191

ABABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.: one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

A.C. and D.C. 1/- Slotmeters. Guaranteed 2 years, 2½-50 amps. From 50/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

ALTERNATORS from ½ to 675kVA in stock, single and three-phase, all voltages and frequencies. Guaranteed. Many unused. Send your requirements.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 162

ALTERNATORS, generators, 1-100 kVA, all voltages. Specialists—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 147

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

BARGAINS in electric motors are always being obtained from A. Cooksley & Co Ltd., 21/25, Tabernacle Street, London, E.C.2 Stocks include A.C. and D.C. motors, second-hand and new up to 30 h.p. Starters, slide rails and pulleys. Ring Mon. 3355 for your requirements. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 140/-. See Quarterly.—Tradex, Surbiton. 170

CABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (EALing 3155/6). 117

CABLE, underground, PILC/VIR/LC. ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CIRCUIT breakers, various sizes in stock. A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS, 110 and 220 v. D.C./230 v. A.C., .5 to 6kVA; also A.C./D.C. Special voltages at short notice.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9 (Colindale 4621-2). 42

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

FLUORESCENT fittings, lamps, starters and control gear for home and export. Fully guaranteed by actual manufacturers. Send for catalogues.—The Anglo-American Electrical Company, Olive Street, Bury, Lancs. 245

FLUORESCENT tubes reconditioned and guaranteed as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks.—The Anglo-American Electrical Company, Bury New Road, Breightmet, Bolton, Lancs. (Telephone, Bolton 7251). 212

FRACTIONAL h.p. motors, new, ex stock, A.C./D.C., Universal, B.T.H., Delco-Remy, G.E.C., Fracmo, Newman, Scophony.—Jeary Electrical Co. Ltd., 5, Lamb's Buildings, London, E.C.1. 126

GENERATING plants, remote and M/F up to 10 kVA; also secondhand A.C. and D.C. sets up to 100 kVA, large stock all types. Special plants built at short notice.—Powerco Ltd., 312, York Road, London, S.W.18 (Tel. VAN. 5234). 151

GENERATING sets for sale, petrol, diesel and steam, from 1 kW up to 700 kW. A.C. and D.C. switchboards.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford. 161

HOUSE service meters, C. & H., Aron, E.A.C., 20-240 v. A.C., 1-ph., 50 c., 2½ amps., 7s. 6d. each, 1s. 6d. postage; 5 amps., 17s. 6d.—Universal Electrical, 217-221, City Road, London, E.C.1. 37

LONDON: 1,000-amp., 110/115-v. D.C. diesel generator set with switchboard, full tropical rated for mobile use; also 600-amp. set similar.—Box 1807.

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTORS, starters, circuit-breakers. Huge stocks of all types, ½ to 300 h.p. Stock list or quote by return.—J. S. Ramsbottom & Co. Ltd., Bow St., Keighley (3774-5-6). 70

NAMEPLATES, engraving, diesinking, stencils.—Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. or D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

PRACTICALLY new Matthew Wylie 100" cable drum flange nailing and cleating machine for sale.—Box 1795.

PREPAYMENT 1s. slot house service meters.—Universal Electrical, 217-221, City Road, London, E.C.1. 36

PURLEY chokes and ballasts. Our 80-w. tapped h.p.f. ballast with starter switch-holder incorporated is proving itself the most popular unit. Suitable for most fittings. 57s. 6d. each subject.—F. W. Blanshard Ltd. (Dept. ER), Purley, Surrey (Uplands 4818/9). 52

QUARTERLY Credit Meters, single & poly-phase, 2½-100 amps. From 17/6d. Also D.C. See Television.—Tradex, Surbiton. 171

ROTARY converters in stock, all sizes: enquiries invited.—Universal Electrical, 221, City Road, London, E.C.1. 34

SMALL BR screws and nuts in steel, brass and stainless steel, from stock.—Premier Screws & Repetition Co. Ltd., Woodgate, Leicester. 180

TELEVISION slotmeters & Time Switches. Details from: Tradex Meter Co., Surbiton. Elmbridge 4487. 172

TIME switches from stock. Reconditioned or new. 12 months' guarantee. Lists from—J. W. Hughes, 3, St. Thomas Street, London Bridge, London, S.E.1 (Tel. HOP 2759). 178

VENNER time switches, 200-240 v. A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1. 38

WARD Leonard motor generator sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

400-cycle to 1,500-cycle motor alternators and alternators.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 27

EQUIPMENT FOR HIRE

GENERATING set hire service. Consult the most experienced firm for A.C. and D.C. units from 2 kW to 240 kW, diesel or petrol, stationary or mobile, sale or hire. 24-hr. breakdown service. — Dawson-Keith Ltd., Hillview Rd., Sutton, Surrey (Fairlands 4401). 46

RELIABLE, self-contained diesel electric generating sets for hire, 2.5 to 260 kW. Night and day maintenance service. Quotations by return. — Whitetrade Limited, Rochester, Kent (Tel. Chatham 41133, 3 lines). 294

ARTICLES WANTED

A.1 buyers of redundant electrical equipment. V.I.R. and armoured cables, A.C./D.C. motors, 110-volt a speciality. Generators and transformers.—Samuel Jefford & Son, Show Place, Arcadia St., Poplar, London, E.14. 314

BRADLEY Redundant Electrical, 74, Eversleigh Rd., London, E.6 (Phone GRA. 2750). London leading clearing house for all redundant electrical stock and equipment, A.C. and D.C. motors, generating plants, welders and diesel sets. Complete factories bought and dismantled if required, also small or large stocks of scrap cable (dismantled if required). Estimates given. 185

HARRINGTON & Sons, reclamation contractors, want redundant A.C./D.C. electric motors and transformers, stocks of cable, etc. — 109, Beaconsfield Street, New Beckton, East Ham, London, E.6 (ALB. 1388). 315

RECOVERED mercury urgently required in small or large quantities. — Sterling Products Ltd., Sterling Works, London, W.13 (Ealing 9248/9). 1795

SURPLUS laminations, enamel copper wire, screws, nuts, flex. Good prices paid. Full details to—Box 199.

SURPLUS stocks of all types of domestic electric appliances wanted for prompt cash. Large funds available.—Spears, 14, Watling St., Shudehill, Manchester (Phone, Blackfriars 1916) (Bankers, Midland Bank Ltd.). 338

WANTED, A.C. motor, 300/400 h.p., 440 volt, 3-phase, 50 cycle, 3,000 r.p.m., complete with starting gear.—James Grant & Coy., 480, Pollokshaws Road, Glasgow, S.1. 1825

WANTED, D.C. and A.C. ball-bearing motors, motor generator sets, dynamos and alternators. Full details to — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 13

WANTED, diesel engines and diesel sets.—H. Murfet, Daleside Rd., Nottingham. 240

WANTED for prompt cash, ferrous and non-ferrous scrap, also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. & H. Cooper Ltd., 176, Brady St., Bethnal Green, London, E.1. 120

WANTED, rotary converters, any sizes.—Universal. 221 City Rd., London E.C.1. 35

WANTED, surplus stock cable, all types and sizes. We can inspect.—Box 220.

WORK WANTED AND OFFERED

A.C. and D.C. motor rewinds and repairs. Prompt service, fully guaranteed.—Edgware 5566/9; Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. 92

METALWORK. All types cabinets, chassis, racks, etc., to your own specifications. Write—Dept. 'S,' Philpott's, Metal Works Ltd., Chapman Street, Loughborough. 211

SMALL armature, stator, transformer and general coil winding undertaken on production run.—Kensal Electrics Ltd., 151, Kensal Rd., London, W.10 (LAD. 4530). 202

AGENCIES

AGENCIES required for conduit, conduit fittings, cable, etc., for the Lancashire and Cheshire area. The advertiser has first-class connections with factors and electric supply authorities. Car available. First-class references available.—Box 9223.

REPRESENTATIVE or agent required to develop areas in (a) North of England and Scotland, (b) Midlands and (c) South and South-West of England, by manufacturers of light fittings and lampshades. Write with full particulars to—Oswald Hollman Ltd., 208, Kent House Road, Beckenham (Tel. Syd. 7994). 1826

BUSINESS OPPORTUNITIES

MANUFACTURERS of quality fluorescent fittings, tubes, starters and control gear wish to contact quantity buyers, wholesalers, agents, etc., interested in purchasing in quantity at special low prices. Advertisers are interested in long or short term arrangements.—Box 213.

PATENT NOTICES

THE proprietors of Patent No. 716469 for "High-frequency coil assembly" desire to secure commercial exploitation by licence or otherwise in the United Kingdom. Replies to Haseltine Lake & Co., 28, Southampton Building, Chancery Lane, London, W.C.2. 1772

EDUCATIONAL

CITY & Guilds (Electrical, etc.) on "No Pass —No Fee" terms. Over 95% successes. For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook. Free and post free.—B.I.E.T. (Dept. 12A), 29, Wright's Lane, London, W.8. 100

LEARN electrical engineering the practical way. Our new self-study course includes equipment on which experimental work can be carried out. Also courses for all professional examinations. Free brochure from E.M.I. Institutes, Dept. ER57, London, W.4 (Associated with H.M.V.). 318

The first full-length study of the subject

INDUSTRIAL BRAZING

By H. R. Brooker and E. V. Beatson, B.SC.(ENG.), A.M.I.E.E.

Industrial brazing as a process for metal fabrication has advanced to such an extent that those engaged in the work have found difficulty in keeping pace with its many developments. This book, written by two leading authorities, provides the first full-length study of the subject. It covers all modern brazing methods, including torch, furnace, high-frequency induction, resistance, salt bath and dip, with chapters on the special techniques necessary for aluminium, stainless steels, beryllium copper, cemented carbides and vacuum tube construction.

35s. net. By post 36s. 6d.

Obtainable from booksellers or direct from Iliffe & Sons Ltd. at the address below.

DORSET HOUSE, STAMFORD ST., LONDON, S.E.1

LIMITED

MIDLAND METALLICS LIMITED

Ryders Green Road, West Bromwich, Staffs.

TELEPHONE: TIPTON 2081

Gravity and Pressure Diecastings

of PRECISION

QUALITY and DISTINCTION

In Aluminium and Zinc Base Alloys

HILDICK & HILDICK

WALSALL TUBE WORKS

PLECK ROAD, WALSALL. Phone WAL. 2123

REGISTERED

MUDIE'S CUBICLE SWITCHGEAR

FRONT ACCESS TYPE
for service up to 5000 amps
at 660 volts

MUDIE'S ELECTRICAL CO. LTD. BIRMINGHAM 28

TRADE MARK

SURQUAL REGD

AUTOMATIC STERILIZER

For Efficient Sterilization

- With Automatic Heat Control and Cut-out.
- Seamless Reinforced Boiler.
- Strong lifting device for tray —heat insulated handles.
- In FIVE SIZES from 9" x 5" x 3" up to 20" x 10" x 7".

SES

SURGICAL EQUIPMENT SUPPLIES LTD
WESTFIELDS ROAD, LONDON, W.3
Name of Local Dealers on request

ACME of Perfection

GOLIATH & EDISON SCREW ELECTRIC LAMPHOLDERS

Patent Nos. 182194 & 24028

Tel.: EALing 6034-5

JULIUS SAX & CO. LTD.
24 COMMERCE ROAD
BRENTFORD · MIDDLESEX
Grams: Saxatile, Phone Brentford Hounslow

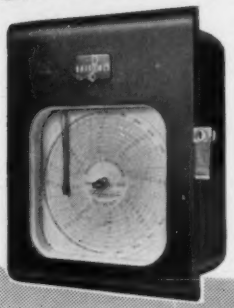
These lampholders are specified wherever a good holder is required.
GOLIATH holders can be relied upon to give years of trouble-free service.
EDISON SCREW holders possess many excellent Mechanical and Electrical features.

Folder with full details of Lampholders sent on request

For all types of electrical instruments

BRISTOL'S SERIES 500 RECORDING VOLTMETERS AND AMMETERS

Robust construction, stable calibration, high actuating torque, low load.

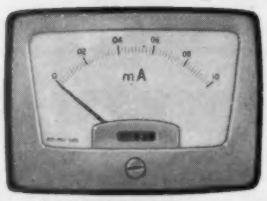


ELLIOTT REFLECTING DYNAMOMETERS

For the measurement of volts, amps and watts. Accurate to 0.5%; stable; models up to 2,500 cycles.

ELLIOTT MULTI-RECORDERS

Instruments for single records and simultaneous recording of from two to six inputs.



SWITCHBOARD AND PANEL INSTRUMENTS

New Rectangular Series. Two-tone, four sizes, wide range of movements.

CIRCULAR DIAL SWITCHBOARD INSTRUMENTS

MINIATURE SWITCHBOARD INSTRUMENTS 3·7" SCALE

ELLIOTT

Electrical Measurement Division, **ELLIOTT BROTHERS (LONDON) LTD., CENTURY WORKS, LONDON, S.E.13 (TIDeway 1271)**

A MEMBER OF THE ELLIOTT-AUTOMATION GROUP

INDEX TO ADVERTISERS

Abbot Brown & Sons Ltd. 84
Acrow (Engineers) Ltd. 61
Adcola Products Ltd. 18
Ainsonic Ltd. 19
Allen, W. H., Sons & Co. Ltd. 52
Allen We... & Co. Ltd. 31
Aluminium Wire & Cable Co. Ltd. 1
Andec Ltd. 46
Anders Electronics Ltd. 106
Ashley Accessories Ltd. 43

Babcock & Wilcox Ltd. 70
Berry's Electric Magicoal Ltd. 72
Birch, H. A., & Co. Ltd. 76
Birkbys Ltd. 13
Blackwell, T., & Son Ltd. 16
Bleeco Ltd. 61
Blickvac Engineering Ltd. 46
Bridge, David, & Co. Ltd. 54
British Electrical Repairs Ltd. 9
British Klockner Switchgear Ltd. ... 20
British Thomson-Houston Co. Ltd. 5
Brook Motors Ltd. 77
Brown, N. C., Ltd. 82
Brush Electrical Engineering Co. Ltd. 3

Checklox 84
City Electrical Co. 106
Collins Electrical Ltd. 26
Colne Switchgear (K & W) Ltd. ... 81
Connollys (Blackley) Ltd. 106
Control Components Ltd. 14
Cosmocord Ltd. 89
Craig & Derricott Ltd. 46
Crompton Parkinson Ltd. 10
Croydon Engineering Co. Ltd. 12
Crypton Equipment Ltd. 48

Daly (Condensers) Ltd. 54
Deco Engineering Co. Ltd. 16
Donovan Electrical Co. Ltd. 22
Drummond, John (Engineers) Ltd. 87
Dubilier Condenser Co. (1925) Ltd. 73

East London Mica Works 22
Electrical Instrument Co. (Hillington) Ltd. 50
Elliott Bros. (London) Ltd. 103
Ellison, Geo., Ltd. 69
Eltron (London) Ltd. 90
Engineering & Lighting Equipment Co. Ltd. 86
English Electric Co. Ltd. ... Cover 1 & 47
Erskine, Heap & Co. Ltd. 11
Express Winding Co. 8

Ferranti Ltd. 41
Fuller Electric Ltd. 15
Furse, W. J., & Co. Ltd. 104

General Cable Mfg. Co. Ltd. 32
General Electric Co. Ltd. ..... 56 & 92
Godwin, H. J., Ltd. 34

Harris & Sheldon (Electrical) Ltd. 64
Henley, Burrowes & Co. Ltd. 78
Henley's, W. T., Telegraph Works Co. Ltd. 49
Hiatt & Co. Ltd. 104
Higgs Motors Ltd. 23
Hildick & Hildick 101
Hunt, A. H. (Capacitors) Ltd. 40

Ilford Ltd. 28
Imhof, Alfred, Ltd. 33
International Combustion Ltd. 35

Johnson, Matthey & Co. Ltd. 36

Keyswitch Co. 104

Lee & Wilkes Ltd. 78
Lewis Spring Co. Ltd. 73
Linread Ltd. 58
Litholite Insulators & St. Albans Mouldings Ltd. 87
Londex Ltd. 57
London Electric Firm Ltd. 14
London Electric Wire Co. & Smiths Ltd. 51
Long & Crawford Ltd. 24

M.K. Electric Ltd. 79
Magnetic Devices Ltd. 80
Manifold Electric Co. Ltd. 65
McGeoch, Wm., & Co. Ltd. 82
Meadows, Henry, Ltd. 88
Measurement Ltd. 83
Mek-Elek Engineering Ltd. 84
Mercury Switch Mfg. Co. Ltd. 19
Meritus (Barnet) Ltd. 90
Metropolitan-Vickers Electrical Co. Ltd. 74
Micanite & Insulators Co. Ltd. ... Cover 2
Midland Coil Winding Co. Ltd. ... 68
Midland Electric Mfg. Co. Ltd. ... 4
Midland Metallics Ltd. 101
Mills, Wm., Ltd. 55
Mole, M., & Son Ltd. 53
Mudie's Electrical Co. Ltd. 102

National Plastics (Sales) Ltd. 2
Nife Batteries 27

Parmiter, Hope & Sugden Ltd. 91
Parsonage, W. F., & Co. Ltd. 16
Partridge, Wilson & Co. Ltd. 61
Philips Electrical Ltd. 81
Pirelli-General Cable Works Ltd. ... 45
Pitman, Sir Isaac, & Sons Ltd. 20
Plant Engineering Co. Ltd. 34
Poles Ltd. 65
Pope's Electric Lamp Co. Ltd. 6
Portable Furnace & Patents Co. ... 20
Prichard, Hugh, & Co. (Nottm.) Ltd. 78
Pritchett & Gold & E.P.S. Co. Ltd. 75

Reyrolle, A., & Co. Ltd. 44
Rists Wires & Cables Ltd. 85
Rollet, H., & Co. Ltd. 25
Rotherham & Sons Ltd. 84
Rowlands Electrical Accessories Ltd. 76
Runbaken Electrical Products 50

Sanders, W., & Co. (Wednesbury) Ltd. 60
Sangamo Weston Ltd. 72
Sax, Julius, & Co. Ltd. 102
Saxonia Electrical Wire Co. Ltd.... 20
Scholes, Geo. H., & Co. ..... 17, 38 & 39
Scottish Cables Ltd. 42
Service Electric Co. Ltd. 106
Siemens Edison Swan Ltd. 105
Simmonds & Stokes (Niphan) Ltd. 16
Skefko Ball Bearing Co. Ltd. ... Cover 4
Smith, Herman, Smithite Ltd. 53
Southern Trade Services Ltd. 34
Sparklets Ltd. 82
Square D. Ltd. ..... Cover 3

Standard Telephones & Cables Ltd. 63
Sterling Varnish Co. Ltd. 30
Stevens & Bullivant Ltd. 34
Stockfield Mfg. Co. Ltd. 19
Sturdy Electric Co. Ltd. 90
Sturtevant Engineering Co. Ltd. ... 7
Surgical Equipment Supplies Ltd. 102

Telco Ltd. 76
Termination Equipment Co. Ltd. ... 90
Thermostatic Controls Co. 61
Thew, Edward H., Ltd. 57
Thorn Electrical Industries Ltd. ... 21
Thorpe, F. W., Ltd. 67
Transformer & Electrical Co. Ltd... 81
Transformers & Rectifiers Ltd. 50
Tullis Russell & Co. Ltd. 37

Universal Electrical Co. 76
Utilities (London) Ltd. 62

Victor Products (Wallsend) Ltd. ... 29
Viscose Development Co. Ltd. 29
Volex Electrical Products Ltd. 66

Wandleside Cable Works Ltd. 78
Washers Ltd. 84
Webber, R. A., Ltd. 50
Willesden Transformer Co. Ltd. ... 87
Wootton & Co. Ltd. 25

Yorkshire Switchgear & Eng. Co. Ltd. 59

Zenith Electric Co. Ltd. 62

ADVERTISEMENT COPY AND BLOCKS

for printing in black and white should reach us 16 days preceding date of issue addressed to The Advertisement Department

ELECTRICAL REVIEW

Dorset House, Stamford Street, LONDON, S.E.1

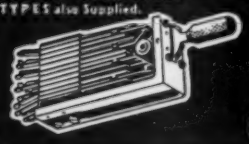
RELAYS

P.O. TYPES MANUFACTURED TO YOUR SPECIFICATION

PROMPT DELIVERY

3000 TYPES

COILS up to 80,000Ω.
CONTACTS up to 8 c/o's
Tropicalizing and impregnating to order.
400 and HIGH-SPEED TYPES also Supplied.



LARGE STOCKS OF KEYSWITCHES

THE KEYSWITCH CO.

ALL POST OFFICE EQUIPMENT

Enquiries to Sales Manager

126 KENSAL ROAD, LONDON, W.10

Telephone: LAD. 0666, 4640 Grams: "Fonequipt", London, W.10

Contractors to Home & Overseas Governments & H.M. Crown Agents

PLASTIC CABLE CLIPS

The Cable Clip is designed to 'push fit' on to the cable.
The carbon steel pin is already part of the unit and will drive into wood, plaster or mortar.

HIATT & CO. LTD. Baltimore Road Birmingham 22B

FURSE

LIGHTNING CONDUCTORS

and Earthing Equipment

Largest Manufacturers and Exporters in Great Britain

Advisory and technical information service free — complete schemes and estimates. Illustrated literature on request.

W. J. FURSE & CO. LIMITED

33 Traffic Street (Tel. 88601-3 lines) NOTTINGHAM

Also LONDON, MANCHESTER, BIRMINGHAM, BRISTOL

SIEMENS EDISWAN

another advance in cable technique

Siemens Edison Swan Ltd., a member of the C.M.A., are proud to announce that the smaller sizes of Class 4101 can now be supplied without a tape. This means smaller diameters and resultant economy in installation. Stocks of the new type cables are available at all branches.

Comparative nominal diameters of standard wiring types

	OLD	NEW
3/029	·165″	·147″
7/029	·190″	·172″
7/036	·220″	·203″

For full details please apply for folder C 1921

SIEMENS EDISON SWAN LTD

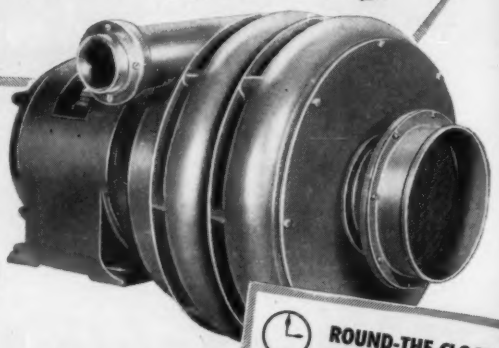
An A.E.I. Company

Rubber & Plastic Cable Division, 155 Charing Cross Road, London, W.C.2

Telephone: Gerrard 8660 Telegrams: Sieswan, Westcent, London

it's High Velocity

suction and blowing



Greater pressure or suction without increased impeller diameter?

Three-stage Model 332. Three 12″ impellers — 2900 r.p.m. — 1½ h.p. Give high pressure and volume with great reliability.

High Performance in Small Spaces?

Series Commutator type — many thousands in use. Data Sheet 104.

Greater reliability against comparatively high W.G. pressure?

Induction motor series —totally enclosed squirrel cage induction motor. Data Sheet 132.

A range of Heaters is available for use with Secomak Blowers giving air temperatures up to 900° F. Ask for Data Sheet 130.

ROUND-THE-CLOCK DEPENDABILITY

Secomak Statair Units (A.C. induction motor series) are designed for use where dependability is the first consideration. They are thoroughly sound engineering jobs, suitable for heavy duties and continuous running — 24 hours daily if necessary.

Secomak REG^D **statair units**

compact . . . adaptable . . . economical

Manufacturing Electrical and Mechanical Engineers, Contractors to Admiralty and Ministry of Supply. A.I.D. Approved.

Write now for full details to the manufacturers

SERVICE ELECTRIC CO. LTD., HONEYPOT LANE, STANMORE, MIDDX.

EDGware 5566/9

MEASURING INSTRUMENTS

IMMEDIATE DELIVERY

Most Basic Ranges available **ex-stock** for immediate despatch. Special ranges – delivery 7/14 days.

Round, Square or Rectangular patterns available, also full range of Industrial Switchboard Instruments. Portable and Laboratory Instruments, Moving Coil, Moving Iron, Thermo Couple, Electrostatic.

We can supply Meters with Non-Standard Ranges in Current, Volts or Ohms. To B.S. 89. Industrial or Precision Grade accuracy.

Clients are invited to inspect the display of instruments at our New Offices and Showrooms.

Turner Model 605
Rectangular Flush 6″ x 5″

Stockists of Meters by Turner, Weston, Baldwin, E.A.C., Weir and other leading manufacturers.

Manufacturers of:

ELECTRONIC TEST EQUIPMENT, NETWORK ANALYSERS, EDUCATIONAL GEOPHYSICAL and SPECIAL INSTRUMENTS, PORTABLE MULTIRANGE TEST SETS at 1 megohm per Volt.

May we quote for your requirements?

ANDERS ELECTRONICS LTD.

103 HAMPSTEAD ROAD, LONDON, N.W.1

Telephone: EUSton 1639

Suppliers to Govt. Depts., B.C.C., Tech. Colleges, Leading Manufacturers & Research Laboratories

Ask for the ORIGINAL Insulating Tape stocked by leading wholesalers

Manufactured by

CONNOLLYS (Blackley) LIMITED

MANCHESTER 9

Tel.: CHEetham Hill 1801

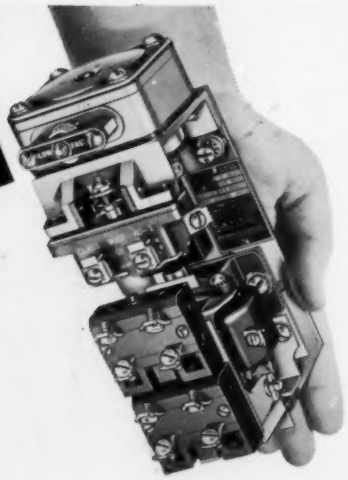
dm CL36

EMERALD STREET, LONDON, W.C.1. HOLBORN 9722

Published by ELECTRICAL REVIEW PUBLICATIONS LTD., at Dorset House, Stamford Street, London, S.E.1 and printed in Great Britain at THE CHAPEL RIVER PRESS, Andover, Hants.

Square D
Design Leadership
in action

3 New timers



New . . . Type B

Now with narrow base for space saving

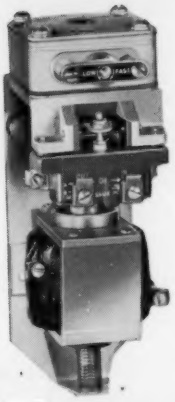
Class 9050 Pneumatic Timers, the machine tool standard for more than 20 years—are now improved to save 38% of mounting space. As before, the A.C. timers have a range from 0.2 seconds to 3 minutes and accommodate up to 2 n.o. and 2 n.c. auxiliary switches. Available for panel mounting or a variety of enclosures.

New . . . Type B

Flush Mounting Timer

Ideally suited for mounting in enclosures or doors where external adjustment is desirable. This A.C. Pneumatic Timer has a heavy sheet steel flush plate and the same range, and high degree of repeat accuracy as all Square D Timers. Type B Timers are convertible from time delay after energisation to after de-energisation. Designate as Class 9050.

Whatever your timing problem— one of these timers will do the job— *Precisely!*



New . . . Type C

D.C. operated

Using the identical timing head as the Type B, these Type C Timers have a D.C. operated magnet for voltages up to 250 Volts D.C. Types B & C Timers are available with micrometer dial or knurled knob adjustment. Also, designate as Class 9050.

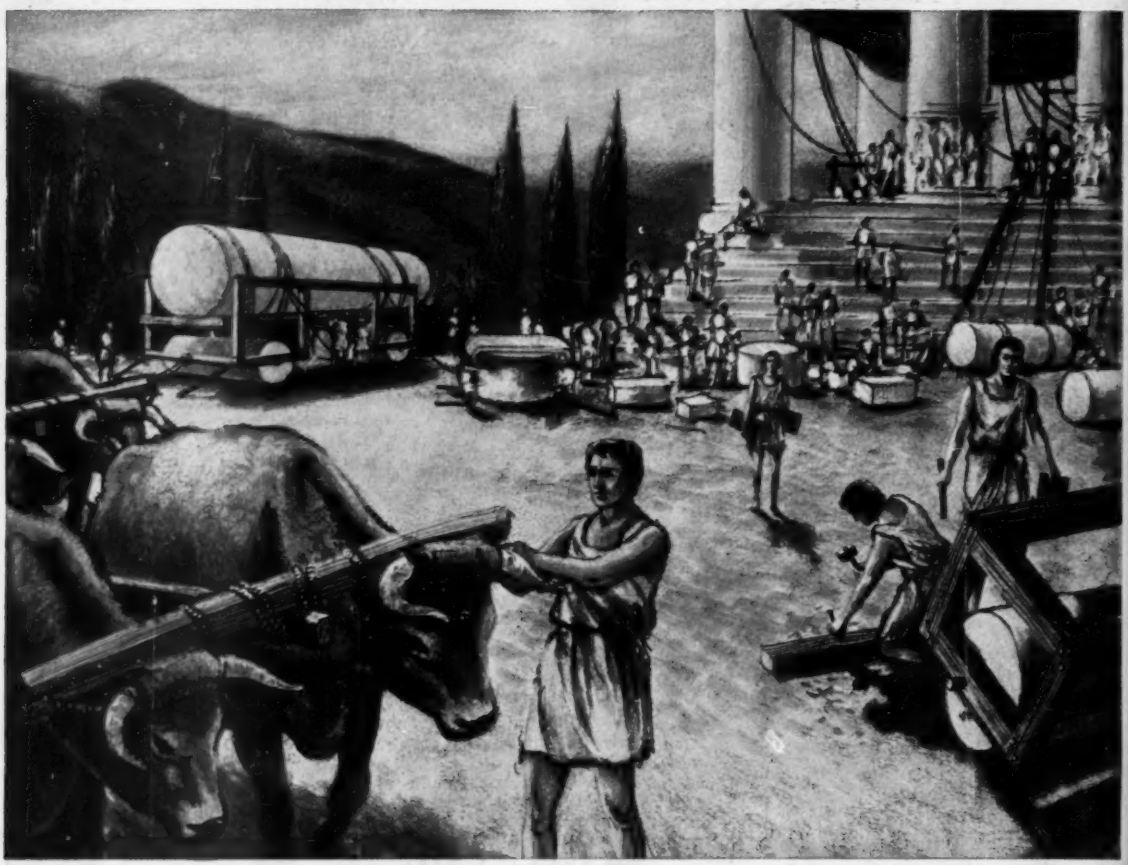
Write for Timer Bulletin 9050

FIELD OFFICES — LONDON · BIRMINGHAM · MANCHESTER AND GLASGOW

SQUARE D LIMITED

100 ALDERSGATE STREET · LONDON E.C.1 · Tel: METropolitan 8646

SD25



The Conquest of Friction

Vitruvius Pollio, writing of the construction of the Temple of Artemis about the time of Julius Cæsar, gives a clear account of the transport to the building site of the large sections of the pillars.

Stone rollers had iron pins fitted in their ends, each roller being provided with a timber frame with bearings for the iron pins. The trucks thus formed were drawn by oxen.

The use of the trunnion overcame the disadvantage of plain rollers, that these had continually to be removed from the rear and brought round to the front.

Nearly 2,000 years later, the comprehensive range of products of the world-wide SKF organisation are easing anti-friction problems of many kinds; helping the wheels of industry to turn faster and more efficiently—and making a major contribution towards better, easier working conditions and a higher standard of living in many lands.

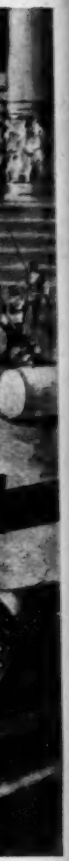
SKF

THE SKEFKO BALL BEARING COMPANY LIMITED · LUTON · BEDS

THE ONLY BRITISH MANUFACTURER OF ALL FOUR BASIC BEARING TYPES: BALL, CYLINDRICAL ROLLER, TAPER ROLLER AND SPHERICAL ROLLER

G149

1958



G149